











# THE NAUTILUS

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TO

## THE NAUTILUS, XXX

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## NOTES ON THE CALIFORNIAN SPECIES OF ADULA.

BY WILLIAM HEALEY DALL.

The genus *Botula* was proposed by Mörch. in 1853, in the second part of the Yoldi catalogue, page 55, for *Modiola vagina* Lamarck and *M. fusca* Gmelin, the latter better known as *M. cinamomea* Lamarck.

The former seems not to differ materially from the typical *Modioli* except in its less arcuate form, and the latter by its small size, incurved umbones and boring habit must be relied on to carry the genus if it is valid. The group now under consideration differs but little from *Botula* so typified, the species grading from one to another so as to nearly bridge the gap between *Botula* and *Lithophaga*. It can hardly rank higher than a subgenus at most.

The subgenus *Adula* was proposed by the brothers Adams in December, 1857, in their "Genera of Recent Mollusca," for the single species *Mytilus soleniformis* of Orbigny, 1846, from Payta, Peru.

The generic name was used again in 1861, by Henry Adams for a *Planorbis*, probably by inadvertence.

The typical species of *Adula* differs from those of the California coast by having more nearly central umbones, if Orbigny's figure can be relied upon.

The earliest of the Californian species to be noticed was :

**ADULA CALIFORNIENSIS Philippi.**

*Modiola californiensis* (Esch. ms.) Philippi, Zeitschr. Mal. for 1847, p. 113. California, Eschscholtz.

*Adula stylina* Carpenter, Rep. Brit. Assoc. for 1863, p. 644, 1864; Ann. Mag. Nat. Hist., 3rd ser., vol. 14, p. 425, Dec. 1864; Smithsonian reprint, p. 237, 1872. Neeah Bay, Wash.

*Modiola (Lithophagus) schmidtii* Schrenck, Amurl. Moll., p. 500, pl. 21, figs. 4-7, Oct. 1867. West coast of Sakhalin Island, Sea of Tartary.

*Adula californiensis* Dunker, Conch. Cab., neue Ausg., viii, pt. 3, *Lithophaga*, p. 22, pl. 5, fig. 19, 1882; Index Moll. Mar. Japan, 1882, p. 227.

Distribution. Neeah Bay, Wash. to San Diego, Cal., Northern Japan and the Sea of Tartary.

This species is shorter than *A. falcata*, and destitute of the of fine transverse surface sculpture which in the latter recalls that of some species of *Lithophaga*. It is slender, with the radial ridges rather emphasized and the shell substance has usually more or less dark bluish coloration.

The posterior dorsal area (where it has not been cleaned off by a collector or dealer) has a more or less velvety pile, such as is often found on *Modiolas*, underneath which the periostracum has a brilliant polish. The umbones in the adult are invariably eroded. The Japanese specimens, received from Hirasé, are quite identical with those from California.

**ADULA DIEGENSIS Dall.**

*Modiolus diegensis* Dall, NAUTILUS, xxiv, No. 10, Feb. 1911, p. 110. San Diego, Cal. (young shells).

Distribution. San Francisco Bay to San Diego, and Cape St. Lucas.

The young specimens of this species are apparently free-living and have less of the arcuation found in the last species, which is a borer.

The adult shell has the posterior portion much more capacious than in *A. californiensis*, nearly twice as wide and high as in specimens of the latter of the same length. The color seems variable. The young shells described by me were dark bluish,

the adults later received from Mrs. E. P. Chace were brownish. The relations of this group to *Myrina* remain to be cleared up.

**ADULA FALCATA** Gould.

*Lithodomus falcatus* Gould, Proc. Boston Soc. N. Hist. iv, p. 92, Nov. 1851; Monterey, Cal.; Gulf of Cal. Shells, Apr. 1852, p. 30, pl. 6, fig. 9.

*Lithodomus grüneri* Reeve, Conch. Icon. *Lithodomus*, 1857, pl. iii, fig. 12. "New Zealand" in error.

*Lithodomus (Lithophaga) falcatus* Gould, Otia. Conch., p. 213, 1862.

*Adula falcata* Dunker, Conch. Cab. neue Ausg., viii, pt. 3, *Lithophaga*, p. 22, pl. 4, figs. 1, 2, 1882.

Distribution. Straits of Fuca to San Diego, Cal., and southward, boring in indurated clay and soft sandstone.

This is the largest of the genus and distinguished from either of the other Californian species by its much greater length and the sculpture of the periostracum.

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**POLYGYRA BREVIPILA CHEROKEENSIS, NEW SUBSPECIES.**

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BY GEO. H. CLAPP.

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Differs from typical *brevipila* (NAUTILUS, xx, p. 110) by its uniformly smaller size and darker color. In both these respects it resembles *cohuttensis*, for which it might be taken at first sight; but the form and details of apertural structures are almost exact reproductions, in miniature, of *brevipila*. At present, it seems better to regard the new form as a sub-species of *brevipila*, though a well marked one. The fact that it has been found in two localities, twenty miles apart, shows that it is not merely a dwarfed local variety. It should be remembered that nearly all the species of *Stenotremes* are markedly constant in size, even when they have a wide geographic range.

Diam. 7 mm. alt. 5 mm. whorls 5.

Type locality: near Pleasant Gap, Cherokee Co, Ala., "in a shady but dry ravine on the mountain side, about 1200 ft. generally under stones." Collected by Herbert H. Smith, Aug.

1915. A single specimen was found near Cave Spring, Floyd Co. Ga. about 20 miles N. E. of the Alabama locality. Types no. 7871 of my collection. Paratypes in collections of Academy of Nat. Sci., Philadelphia, Alabama Museum of Natural Hist., and cabinet of Dr. Bryant Walker.

*Polygyra brevipila*, *cherokeensis* and *cohuttensis* form an interesting and very natural group, differing from *stenotrema*, *hirsuta* and their allies by the continuous free lip and the shape of the lip notch. Other common characters are the fine, closely-set hairs and very convex, rounded body whorl. The fulcrum is long. The known localities are all in the southern extension of the Allegheny mountain range, from N. W. Georgia to central Alabama. All the species occur in wooded but rather dry ravines on mountain sides, and they commonly conceal themselves by clinging to the lower sides of stones. *Polygyra brevipila* was collected in such a ravine, about 2000 ft. above sea level; *cohuttensis* at about 1500 ft. ; and *cherokeensis* at 1200 ft.

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#### GONIOBASIS IN WESTERN PENNSYLVANIA.

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BY H. A. PILSBRY.

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##### GONIOBASIS PENNSYLVANICA n. sp.

The shell is oblong-conic, rather solid, smooth; periostracum strong and persistent, of a buffy citrine color. The spire is conic, with straight or slightly convex outlines, and is more or less eroded, the erosion beginning at an early age. The young up to a length of about 6 or 7 mm. are acutely carinate peripherally, the carina appearing as a welt or seam immediately above the suture on the spire; after which the periphery becomes merely convex or somewhat flattened. The last whorl is large, tapering downward. Aperture more than half the total length, ovate; outer lip very slightly sinuous, almost straight in profile view. Parietal callus rather thin.

Length 16.5, diam. 10, length aperture 10 mm.

Length 16, diam. 8.3, length aperture 9 mm.



Operculum with the nucleus at about the lower sixth of the total length.

*Distribution*.—Ohio river system in western Pennsylvania. Ohio River at Coraopolis (type locality; S. N. Rhoads, Sept. 1898); Neville Island, Allegheny Co.; Beaver River below Wampum (Rhoads); Allegheny River (E. A. Randall, 1868); Pittsburgh (H. S. Stupakoff, 1895). Type and cotypes No. 73954 A. N. S. P.

While related to *G. depygis* (Say) and *G. livescens* (Mke.), this species is readily known by its short spire, bright olivaceous yellow color and the strong, persistent cuticle. It was found in abundance by Mr. Rhoads, and was listed by him as *Goniobasis depygis* (NAUTILUS XII, April, 1899, p. 137). Though I have not seen the specimens, it is apparently what Dr. Ortmann catalogued as *Goniobasis translucens* Anth. (Proc. Amer. Philos. Soc., Vol. 52, 1913, p. 328). If so, it occurs as far upstream as Warren Co., Pa.

Some individuals have two rather wide carob-brown bands, occupying the middle of the spaces above and below the periphery. Sometimes there are narrow bands very near the suture and columella, the latter visible inside.

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#### THE FRESH-WATER MOLLUSCA OF ONEIDA LAKE, NEW YORK.

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BY FRANK C. BAKER.

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Oneida Lake lies near the center of New York State in latitude 43° north and longitude 75° west. Oswego and Oneida counties border the lake on the north and Onondaga and Madison counties on the south. It is 27 miles southeast of Lake Ontario. The lake is oriented almost directly east and west, which is the longer axis, and is 21 miles in length by 5.50 miles in greatest width. The level of the lake is 369 feet above the sea or 124 feet above Lake Ontario. The greatest depth recorded is 55 feet, which occurs about one and a half miles southeast of Cleveland. The shores are relatively very low, as the lake is in the bed of an ancient glacial lake, lacking the

bold character of the land in the vicinity of the Finger Lake region farther south, where lakes Cayuga, Seneca, etc., lie in preglacial rock-cut valleys. The general depression of the country immediately surrounding the lake produces low, swampy shores on many parts of the lake, especially at the east and west ends. Large swamp areas occur in Big Bay, Maple Bay, west of Constantia, and at the east end where Fish Creek enters the lake.

Oneida Lake is the largest inland body of water in the State, having an approximate area of 80 square miles and a shore line of approximately 65 miles. The areas bordering the shores are always shallow and usually deepen rather abruptly, forming in many places submerged terraces of greater or less width. These terraces are either sandy or bouldery in character, usually the latter, the rough water washing out the fine particles and removing them to the quieter bays and protected areas near the points. For this reason the points are always stony and bouldery and the bays sandy. A notable fact is the almost total absence of mud on the shores of the west end of the lake, mud areas being confined to a few small spots, principally at the mouth of small creeks. The shallow zones bordering the shores, 6 feet or less in depth, are from 200 to 1600 feet in width, and the approximate area of shallow water within the 6-foot contour is estimated to be upwards of  $6\frac{1}{2}$  square miles or 8 per cent. of the entire area. This is significant when it is remembered that this shallow zone is nearly all covered with vegetation and is the area which supports all of the animal life and affords breeding grounds for the majority of the fishes in the lake. If we include the bottom area enclosed by the 12-foot contour, below which little or no vegetation lives, we find the total approximate area to be 8366 square acres (13 square miles), which afford feeding grounds for fish and other aquatic animals. The west end of the lake, which is the only part at present investigated, is very shallow, scarcely exceeding 20 feet in depth beyond Frenchman Island.

The noteworthy species are *Physa ancillaria warreniana*, *Planorbis binneyi*, and *Lymnæa stagnalis lillianæ*, which appear to be new records for the State. These species are common in Toma-

hawk Lake, Wisconsin, where they occupy habitats similar to those in Oneida Lake. This is an interesting case of distribution. *Acella haldemani*, *Bythinia tentaculata* and *Vivipara connectoides* add new localities to the State. The 10 species of *Pisidia*, 4 of which are still undetermined, is noteworthy. *Margaritana* had previously been reported from Oneida Lake and the record is now substantiated. A number of common species are reported for the first time from this general region. No list of Oneida Lake mollusks is known to the writer. Beauchamp, however, published an excellent list of the Mollusca of Onondaga County, some years ago, and this is the only paper on the mollusks of this region known to the writer. Further studies will doubtless raise the list to upwards of 100 species and races. Additions are to be expected in *Pisidium*, *Sphærium*, *Musculium*, *Amnicolidæ*, *Valvata*, *Physa*, and *Galba*.

The studies from which this list has been compiled have been carried on by the writer for the New York State College of Forestry at Syracuse University under the direction of Professor C. C. Adams, Forest Zoologist, for the purpose of ascertaining the relation of the molluscan fauna to the feeding habits and breeding grounds of the fish fauna of the lake, especially the food and game fish. Full information concerning the ecological associations and economic value of the mollusks recorded may be found in Technical Bulletin No. 4, now in press, published by the College of Forestry. The author is indebted to Dr. H. A. Pilsbry, Dr. V. Sterki, and Dr. Bryant Walker for assistance in determining critical molluscan material.

#### CLASS PELECYPODA

##### Family Unionidæ.

<i>Lampsilis luteola</i> (Lam.)	<i>Anodonta cataracta</i> Say.
<i>Lampsilis radiata</i> (Gmelin)	<i>Anodonta marginata</i> Say.
<i>Lampsilis borealis</i> (Gray)	<i>Anodonta implicata</i> Say.
<i>Lampsilis iris</i> (Lea)	<i>Anodonta grandis</i> Say.
<i>Nephronajas ligamentina</i> (Lam.)	<i>Anodonta grandis footiana</i> Lea.
<i>Strophitus edentulus</i> (Say)	<i>Alasmidonta undulata</i> (Say)
<i>Strophitus undulatus</i> (Say)	<i>Elliptio complanatus</i> (Dillwyn)

Family *Margaritanidæ**Margaritana margaritifera* (Linné)Family *Sphaeriidæ*.*Sphærium striatinum* (Lamarck)*Pisidium variabile* Prime.*Pisidium compressum* Prime.*Sphærium vermontanum* Prime.*Pisidium compressum lævigatum* Sterki.*Musculium securis* (Prime)*Pisidium henslowanum**Musculium rosaceum* (Prime)

(Sheppard)

*Pisidium ferrugineum* Prime.*Pisidium*, 4 undet. spp.*Pisidium æquilaterale* Prime.

## CLASS GASTROPODA.

Family *Viviparidæ*.*Vivipara contectoides* W. G. Binney.*Campeloma decisum* (Say)*Campeloma integrum* (DeKay)Family *Amnicolidæ*.*Amnicola limosa* (Say)*Somatogyryus subglobosus* (Say)*Amnicola lustrica* Pilsbry*Gillia altilis* (Say)*Amnicola lustrica* Pilsbry, variety*Bythinia tentaculata* (Linné)Family *Valvatidæ*.*Valvata tricarinata* (Say)*Valvata bicarinata normalis* WalkerFamily *Pleuroceridæ*.*Goniobasis livescens* (Menke)Family *Physidæ*.*Physa ancillaria warreniana* (Lea)*Physa integra* Haldeman.*Physa gyrina* SayFamily *Ancylidæ*.*Ancylus tardus* Say*Ancylus parallelus* Haldeman.*Ancylus fuscus* C. B. Adams.



*Family Planorbidæ.*

<i>Planorbis trivolvis</i> Say	<i>Planorbis campanulatus</i> Say.
<i>Planorbis trivolvis</i> Say, variety	<i>Planorbis parvus</i> Say.
	<i>Planorbis hirsutus</i> Gould.
<i>Planorbis binneyi</i> Tryon.	<i>Planorbis exacuus</i> Say.
<i>Planorbis antrosus</i> Conrad.	

*Family Lymnaeidæ.*

<i>Lymnæa stagnalis</i> lillianæ Baker.	<i>Acella haldemani</i> (Deshayes)
	<i>Galba palustris</i> (Mueller)
<i>Pseudosuccinea columella</i> (Say)	<i>Galba catascopium</i> (Say)
<i>Pseudosuccinea chalybea</i> (Gould)	<i>Galba emarginata</i> (Say)

*Family Succineidæ.*

<i>Succinea retusa</i> Lea.	<i>Succinea avara</i> Say.
New York State College of Forestry, Syracuse University.	

## PUBLICATIONS RECEIVED.

THE CRUISE OF THE TOMAS BARRERA : THE NARRATIVE OF A SCIENTIFIC EXPEDITION TO WESTERN CUBA AND THE COLORADOS REEFS, WITH OBSERVATIONS ON THE GEOLOGY, FAUNA AND FLORA OF THE REGION. By John B. Henderson.<sup>1</sup>—This is the narrative of a six weeks cruise during May and June, 1914, planned by the author with the advice of Dr. Carlos de la Torre of Havana. Other naturalists invited to join the party were Mr. George H. Clapp, Dr. Paul Bartsch, Mr. C. T. Simpson, Sr. Manuel Lesmes and Victor J. Rodriguez. Preparators and assistants, an amphibious Patron (Captain) and a crew of seven completed the party. The *Tomas Barrera* was 65-foot fishing schooner, and the route was to Cape San Antonio and return to Havana. Inland trips were made to Pan de Azucar, the Sierra de Viñales, Pan de Guajaibon and other places.

<sup>1</sup> Pp. 320 ; G. P. Putnam's Sons.

Several of the classics of natural history were inspired by tropical America, but so far as we remember, no nature book of interest to the general reader has taken Cuba, our nearest tropical neighbor, for its subject.

Although the author has special knowledge of mollusks, it is quite evident that he is first of all a lover of nature. Now it is the little Cuban tody which appeals to him, and again, a big luminous beetle or a marvelous palm. His description of the reef pools with their strange and beautiful families, of the wierd land crabs and their ways, and of collecting marine animals with a submarine electric light, stick in one's memory. What naturalist can read about the "Cove of delight" in the Viñales Sierra without longing to visit that wonderful region. The human interest which even the most vivid nature-book needs, is supplied by the adventures and misadventures of the party from day by day, and the contact with Cubans, for whom the author evidently has a sympathetic liking.

Thirty-seven full-page illustrations, charming Cuban views, and characteristic animals and plants, add much to the interest of the volume. The bird plates, by Fuertes, and those of coral-pool fishes, are in color.

Those who have been in the tropics will renew their thrills in Mr. Henderson's pages, while naturalists who have not had that experience as yet, may realize the conditions a naturalist finds among the sierras, "mogotes" and on the coral reefs of Cuba.—H. A. P.

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REVIEW OF SOME BIVALVE SHELLS OF THE GROUP ANATINACEA FROM THE WEST COAST OF AMERICA. By William Healey Dall (Proc. U. S. Nat. Mus. Vol. 49, Nov. 1915). Pending the appearance of a comprehensive work on the West American marine shells, the series of descriptive and revisionary papers by Doctor Dall is indispensable to working conchologists. The present one deals with a group which has been little studied on the West Coast. Six new species of *Thracia*, six of *Cyathodonta*, three *Kennerlyia*, one each of *Coelodon*, *Foveadens* and *Lyonsia* are described, several being from such well-known localities as Santa Barbara and San Diego Bay. Others are

from points between Alaska and the Strait of Magellan, and one, *Cyathodonta cruziana*, from Santa Cruz, West Indies.

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PRODROME OF A REVISION OF THE CHRYSODOMOID WHELKS OF THE BOREAL AND ARCTIC REGIONS. By W. H. Dall. (Proc. Biol. Soc. Washington, pp. 7, 8, Jan, 25, 1916). An extended and intricate subject is presented here in tabloid form. A few changes affecting well-known American species may be noted.

*Chrysodomus dirus* becomes *Searlesia dira* (Rve.).

*Chrysodomus* or *Sipho islandicus* and related species belong to the genus *Colus*.

*Chrysodomus kelseyi* becomes *Exilia kelseyi* (Dall).

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REDISCOVERY OF POURTALES' HALIOTIS. By John B. Henderson. (Proc. U. S. Nat. Mus. Vol. 48, 1915). In 1869 Count Pourtales dredged a *Haliotis* in the Straits of Florida, which was subsequently destroyed in the Chicago fire. It was described from memory by Dr. Dall in 1881, as *Haliotis pourtalesii*. In 1911 Mr. Henderson, dredging on the "Pourtales Plateau" off Key West, in 90 fathoms, had the good fortune to secure another specimen, which is described and figured in this paper. It was first announced in THE NAUTILUS, vol. 25, p. 81. As *Haliotis* on the Eastern American coasts had become almost mythical, this was one of the most interesting finds of recent years in those waters. A species from the Galapagos, which Dr. Dall had subsequently identified as *H. pourtalesii*, is renamed *Haliotis dalli* Henderson. Both are figured.

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THREE NEW SPECIES OF ANODONTITES FROM BRAZIL. By Wm. B. Marshall. (Proc. U. S. Nat. Mus., vol. 49, Dec. 1915). *A. salmonea*, *A. darochai* are *A. aurora* are new species from Ceara, Brazil.

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A LIST OF SHELLS COLLECTED IN ARIZONA, NEW MEXICO, TEXAS AND OKLAHOMA BY DR. E. C. CASE. By Bryant Walker. (Occ. Papers Mus. of Zool., Univ. of Michigan, No. 15. Dec., 1915). These lists record shells taken from stream debris in many localities, often remote from places which have been

visited by conchologists. It is a valuable addition to our knowledge of these arid-region faunas.

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NEW FRESH-WATER SHELLS FROM THE OZARK MOUNTAINS. By Anson A. Hinkley (Proc. U. S. Nat. Mus. vol. 49, Dec. 1915). The following new species are described: *Anculosa arkansensis*, *Pyrgulopsis ozarkensis* and *Somatogyrus crassilabris*<sup>1</sup> all from the North Fork of White River, near Norfolk, Arkansas.

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THREE NEW HELICES FROM CALIFORNIA. By S. S. Berry. (Univ. of California Publications in Zoology, Vol. 16, No. 9. January 5, 1916). *Epiphragmophora petricola*, *E. tudiculata rufiterrae*, and *Polygyra pinicola* are described as new from the San Bernardino Mts., near Redlands and back of Pacific Grove, Monterey Co., respectively.—H. A. P.

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#### NOTES.

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OPEAS MAURITIANUM (Pfr.)—*Subulina octona* (Brug.) was reported from green-houses at Philadelphia, Pa. in THE NAUTILUS volume vi, p. 107, (1893) and volume xi, p. 120 (1898). Upon examining one of these sets collected by Mr. Robert Walton, I found one specimen of *Opeas mauritianum* (Pfr.) This is an addition to the "Mollusk Fauna of Philadelphia" published by Mr. Morris Schick in THE NAUTILUS, volume viii, p. 133 (1895). The specimen is in the collection of The Academy of Natural Sciences of Philadelphia, tray No. 113421. We also have *Opeas mauritianum* in the the collection from a green-house at Garfield Park, Chicago, Illinois, being A. N. S. P. No. 91237, collected by Mr. F. C. Baker in 1906; also No. 11748 collected at Washington, D. C., by Mr. E. Lehnert many years ago.—E. G. VANATTA.

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WE have learned with deep regret of the death, on the 26th of March, of DR. WILHELM KOBELT, the distinguished German conchologist, at the age of 76.

<sup>1</sup> This species was first defined by Walker, in NAUTILUS vol. 29, p. 53.

# THE NAUTILUS.

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VOL. XXX.

JUNE, 1916.

No. 2

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## BREEDING RECORD OF MISSOURI MUSSELS.

BY W. I. UTTERBACK.

The following record includes twenty-six of the most representative species of the different subfamilies of *Naiades* for Missouri. Actual numbers of mussels are recorded for those collected in north and northwest Missouri but no definite record of numbers of sterile and gravid individuals could be kept by the author in his survey of the Osage River from the latter part of June to the middle of August while under the direction of the U. S. Fisheries Biological Station, Fairport, Iowa.<sup>1</sup> The revised nomenclature for the *Naiades* is followed in this report since the revival of *Rafinesque*<sup>2</sup> has been accepted by the leading students, and since, too, it has been found that the glochidial and marsupial characters are the best bases for classification;<sup>3</sup> however, for the sake of clearness, the more familiar names appear as synonyms in parentheses after the revised names.

In the following tables the kinds of glochidia are indicated thus:

*Lamp.* = *Lampsilis* type (i. e., suboval-subelliptic, spineless glochidia).

*An.* = *Anodonta* type (i. e., subtriangular, spined glochidia).

*Prop.* = *Proptera* type (i. e., axe-shaped, spined-spineless glochidia).

<sup>1</sup> U. S. Bu. Fish., Econ. Cir., No. 10, 1914.

<sup>2</sup> L. S. Frierson, 1914 a, (NAUTILUS, xxviii, pp. 6-8; E. G. Vanatta, 1915 a, (Proc. Acad. Nat. Sci. Phila., pp. 549-559).

<sup>3</sup> Dr. A. E. Ortmann, 1911 b, (Mem. Carnegie Mus., iv, pp. 279-339; 1912 b, (An. Car. Mus., viii, pp. 222-365).

TABLE I  
BREEDING RECORD OF SHORT (OR "SUMMER") PERIOD BREEDERS (BRADYCTIC SPECIES)

MUSSEL SPECIES	MONTHS WHEN BEARING GLOCHIDIA												Kind of Glochidia
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1. FUSCONAIA UNDATA (Barnes)..... <i>Quadrula trigona</i> (Lea)	.....	.....	.....	.....	.....	X	.....	X	.....	.....	.....	.. ...	Lamp.
2. AMBLEMA PPLICATA (Say)..... <i>Quadrula plicata</i>	.....	.....	.....	.....	.....	X	.....	.....	.....	.....	.....	.....	"
3. MEGALONAIAS HEROS (Say)..... <i>Quadrula heros</i>	X	X	.....	.....	.....	.....	.....	.....	.....	.....	.....	X	"
4. QUADRULA PUSTULOSA (Lea)..... <i>Quadrula quadrula</i> (Raf.)	.....	.....	.....	.....	.....	X	.....	.....	.....	.....	.....	.....	"
5. QUADRULA QUADRULA (Lea) <i>Quadrula lachrymosa</i> (Lea)	.....	.....	.....	.....	.....	X	.....	.....	.....	.....	.....	.....	"
6. QUADRULA VERRUCOSA (Raf.)..... <i>Tritogonia tuberculata</i> (Simp.)	.....	.....	.....	.....	.....	X	.....	.....	.....	.....	.....	.....	"
7. ROTUNDARIA TUBERCULATA (Raf.)..... <i>Quadrula tuberculata</i> (Simp.)	.....	.....	.....	.....	.....	.....	X	X	.....	.....	.....	.....	"
8. ELLIPTIO DILATATA (Raf.)..... <i>Unio gibbosa</i> (Barnes)	.....	.....	.....	.....	.....	.....	X	X	.....	.....	.....	.....	"
9. UNIOMERIS TETRALASMA (Say)..... <i>Unio tetralasma</i> (Say)	.....	.....	.....	.....	X	.....	.....	X	.....	.....	.....	.....	"
10. OBLIQUARIA REFLEXA (Raf.).....	.....	.....	.....	.....	.....	X	X	X	.....	.....	.....	.....	"



TABLE II.—BREEDING RECORD OF LONG (OR "WINTER") PERIOD BREEDERS (BRADYTYCTIC SPECIES)

MUSSEL SPECIES	MONTHS WHEN BEARING GLOCHIDIA												Kind of Glochidia
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1. LASMIGONA COMPLANATA (Barnes) <i>Symphynota complanata</i>	x	.....	x	.....	.....	.....	.....	.....	.....	.....	x	x	An.
2. ARCIDENS CONFRAGOSUS (Say)	x	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	"
3. LASTENA SUBORBICULATA (Say) <i>Anodonta suborbiculata</i> (Say)	x	x	.....	.....	.....	.....	.....	.....	.....	.....	.....	x	"
4. LASTENA OHIENSIS (Raf.) <i>Anodonta imbecillis</i> (Say)	x	x	.....	.....	.....	x	x	.....	.....	.....	.....	.....	"
5. ANODONTA GRANDIS (Say)	x	x	x	.....	.....	.....	.....	.....	.....	.....	.....	x	"
6. STROPHITUS EDENTULUS (Say)	.....	.....	.....	x	x	.....	x	.....	.....	.....	.....	.....	"
7. AMYGDALONAIAS DONACIFORMIS (Lea) <i>Plagiola donaciformis</i> (Lea)	.....	.....	.....	.....	x	.....	.....	.....	.....	.....	.....	.....	Lamp.
8. LASMIGONA FRAGILIS (Barnes) <i>Lampsilis fragilis</i> (Barnes)	x	x	.....	x	x	x	x	.....	x	x	x	x	"
9. PROPTERA ALATA (Say) <i>Lampsilis alata</i> (Say)	x	x	.....	.....	.....	x	.....	.....	x	x	x	.....	Prop.
10. PROPTERA LAEVISSIMA (Lea)	x	.....	x	.....	.....	x	x	x	x	.....	x	.....	"
11. PROPTERA CAPAX (Green) <i>Lampsilis laevissima</i>	.....	.....	.....	.....	.....	x	.....	.....	.....	.....	.....	.....	"
12. LAMPISILIS CAPAX (Barnes) <i>Lampsilis parva</i>	.....	.....	.....	.....	.....	x	.....	.....	.....	.....	.....	.....	Lamp.
13. EURYNIA SUBROSTRATA (Say) <i>Lampsilis subrostrata</i>	.....	.....	.....	.....	.....	x	.....	.....	.....	.....	.....	.....	"
14. LAMPISILIS ANODONTOIDES (Lea)	x	x	.....	.....	.....	x	.....	.....	.....	x	.....	.....	"
15. LAMPISILIS LUTEOLA (Lamarck)	.....	.....	.....	.....	x	x	x	.....	.....	.....	.....	.....	"
16. LAMPISILIS CARDIA (Raf.) <i>Lampsilis ventricosa</i> (Barnes)	.....	.....	.....	.....	x	x	x	x	x	.....	.....	.....	"



Special attention would be directed to the fact that this record includes four instances of the male discharging sperm, one in case of *Lasmigona complanata* (Say), two instances of *Lastena suborbiculata* (Say) and one of *Lampsilis cardia* (Raf.), all observed in the laboratory aquarium. In case of both *complanata* and *suborbiculata* this physiologic fact disproves the report that, like their nearest allies, *Lasmigona compressa* (Lea) and *Lastena ohioensis* (Raf.), are hermaphroditic. Another instance of sperm discharge for *Lampsilis cardia* was observed in nature. This discharge was observed as a tiny stream of milky white cysts. Upon examination with a lens, magnifying 385 diameters, these cysts were observed to be hollow globular masses of sperm, each cyst revolving through the water by means of the flagella of hundreds of sperm cells thrust out through the matrix. It was the pleasure of the author to verify the observations of Dr. A. E. Ortmann, (1911a, p. 319), in discovering on several instances the female of this same species, (*cardia*), buried in the gravel with only the siphons, mantle flaps and two blackish ovisacs exposed. The ribbon-like flaps waved to and fro in an undulating manner and occasionally a white leaf-like conglutinate would be discharged. It was noted that the marsupia of this species were sterile and receptive on occasion of the sperm discharge.

Another physiologic observation, made in the laboratory, should be mentioned here in connection with the reproductive functions of the *Naiades* and that was in case of the rotary motion of the late embryos of *Pleurobema obliquum coccineum* (Conrad) and of *Lastena ohioensis* (Raf.). These are noted to be revolving clock-wise around one axis at the rate of about fifty times per minute. This phenomenon may be common with all species of *Naiades* and the reason why only seldom seen may be because of the short duration of this embryonic activity which may be necessary in the final development into the glochidial stage, for it was only in this structural stage that this rotary motion was seen.

The most prolific and continuous breeder, found by the writer, is *Lasmonos fragilis*. This mussel, being the predominant form in northwest Missouri and thus being the most

accessible, ample opportunity was given to obtain the most complete record and has been found gravid with ripe glochidia every month of the year except for March and August. However, high water prevented the keeping of a complete record for any species during March. In all probability *fragilis* bears glochidia throughout this month also as more individuals of this species were found in glochidial gravity during the month immediately preceding than at any other time of the year. Hence, we would conclude that this species is bradyctic (i. e., a long-period breeder) with an overlapping breeding season. *Lastena ohioensis* and *Strophitus edentulus* may be classed likewise because of the same character in that they also overlap in their breeding season. The fact of non-parasitism as the normal habit of these last mentioned may account for their eccentricities of breeding season. We may also account for the very peculiar marsupial structures of *S. edentulus* because of this independent metamorphosis of its larva. As far as now known all species of *Naiades*, except the last named, are dependent upon fish-hosts as their natural distributors; however, the wide distribution of both *S. edentulus* and *L. ohioensis* has been considered to be due to the buoyancy of the *placentulae*, (gelatinous cords holding glochidia), discharged by the former and also to the very light papery shells of both juvenile and adult of the latter.

Probably this account will show the *smallest gravid individual* on record. On March 3, 1913, a gravid *Proptera laevissima*, bearing mature glochidia, was collected by the writer in Lake Contrary, St. Joseph, Mo., measuring 39 mm. in length, and on September 10, 1914, 61 *laevissima* were collected, 32 of which were found gravid with ripe glochidia. Strange to say, these *female shells* were all smaller than the other 29 males; however, none in this collection exceeded 43 mm. in length, two being only 39 mm. long. Upon further study it may be found that these so-called *laevissima* are really distinct species and that the occurrence of smaller shells may be found to be normal, as seen in case of *Obliquaria reflexa* and of *Plagiola lineolata* (Raf.) (= *P. securis* [Lea]).

The Breeding Record kept herein corresponds with those of

Ortmann, Sterki,<sup>1</sup> Surber,<sup>2</sup> Howard,<sup>3</sup> Lefevre and Curtis<sup>4</sup> in the exceptions which these authors make for the general rule that the species of the sub-family *Unioninae* are short-period breeders (tachytictic) and those of the sub-families *Anodontinae* and *Lampsilinae* are long-period breeders (bradytictic). The writer agrees with Surber<sup>2</sup> and Howard<sup>3</sup> that *Megalonaia heros* should be classed as doubtfully bradytictic. Probably it would be more nearly correct to consider *heros* as *tachytictic with the latest breeding season* known. Another case of eccentricity of breeding season is that of *Obliquaria reflexa*. Although this species belongs to the sub-family possessing long period of gravidity as the rule, yet the writer has only found it sterile during every month of the winter season. *Amygdalonaia donaciformis* has also been found to be sterile in a few instances throughout the winter months, yet this knowledge may be too meagre to establish it as a short-period breeder. However, being found gravid with mature glochidia the early part of June may be partial evidence that this species is bradytictic. The writer is able to verify Surber's discovery that *donaciformis* produces the *smallest glochidium* (0.060x0.063 mm.) on record,<sup>2</sup> and also that, in its metamorphosis, the encysted young shows the unusual growth of adult shell beyond the margin of the glochidial shell.

In keeping this record it was occasionally noted that in a few cases, especially as found in *Lasmigona complanata* and *Lasmonos fragilis*, that the marsupia would contain early and late embryos, and even mature glochidia, at the same time. However, this irregularity is doubtless abnormal since uniformity of development and maturity is the rule for all species.

It may be of interest here to state how the author has been enabled to distinguish sterile females from males of those species which have no sexual dimorphism of shell and no definite differentiation of marsupium and of post-ventral mantel margin as seen in the *Unioninae* and *Anodontinae*. In most cases, as

<sup>1</sup> 1903a (American Nat., xxvii, pp. 103-113).

<sup>2</sup> 1912a (U. S. Bu. Fish., Doc. 771).

<sup>3</sup> 1915 (Nautilus, xxix, pp. 4-11).

<sup>4</sup> 1912 (U. S. Bu. Fish., xxx, Doc. No. 756).

pointed out by Dr. Ortmann, even a macroscopic examination will enable one to note that the septa (vertical partitions for the ovisacs) of the sterile marsupium are distinctly more crowded than those that separate the gill chambers of the male gills. A histologic study shows five or ten gill filaments between the septa of the sterile marsupium or brood pouch.

Tables 2 and 3 are summarized accounts made out from complete individual records kept on the regular form issued by the U. S. Bureau of Fisheries for Biological Stations. These individual accounts of the different species comprehended the sterile females as well as those gravid with early-late embryos and mature-immature glochidia. As proof of this record the author still holds in his possession the preserved anatomical material, gravid with glochidia and also much that is gravid with early and late embryos. The soft parts have been preserved with the shells, the latter having been cleaned in a solution of sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) made by dissolving five pounds of this chemical in five gallons of water. Then the soft parts were preserved in the marked shells after the right valves were cut loose and temporarily examined afiel when the best studies can be made before the tissues are contracted or discolored by the preservative. The best preservative for the whole specimens has been found by the author to be 70 or 80 per cent. alcohol, since such preserving fluids as formaldehyde contain so much free acid that the shell is deteriorated by the chemical reaction upon the limy composition.

While the writer was engaged for over three years in procuring data for his illustrated and descriptive catalogue of the *Naiades* of Missouri<sup>1</sup> it was his good fortune to discover a few glochidia, which follow in the descriptive table here, as the first on actual record. The author is indebted to Dr. T. Surber for his acknowledgement of the novelty and also for his verification of measurements of these glochidia.

The author is confident that fertilization of the ova takes place in the suprabranchial canals and when more data is at hand this determination may be set forth as a well-proven phe-

<sup>1</sup> American Midland Naturalist, Vol. iv, 1915-1916, Plates I-XXVIII.

TABLE III  
NEW GLOCHIDIA

Mussel Species	Description of Glochidia						Locality in Missouri
	Kinds	Mm. Long	Mm. Wide	General Outline	Ventral Margin	Hinge Line	
1. <i>Amblema perplicata quintardii</i> (Cragin).	Lamp.	.205	.215	Suboval	Spineless	Straight	Osage R., Warsaw.
2. <i>Rotundaria tuberculata</i> (Rafinesque). ....	"	.267	.325	Subelliptic	Spineless	Straight	Osage R., Osceola.
3. <i>Pleurobema obliquum solidum</i> (Lea) ...	"	.170	.180	Suboval	Spineless	Straight	Osage R., Schell City.
4. <i>Uniomereus tetralasma</i> (Say).....	"	.160	.210	Subelliptic	Spineless	Straight	Lost Cr., Maysville.
5. <i>Lastena suborbiculata</i> (Say).....	An.	.325	.320	Subtriangular	Spined	Undulate	Lake Contrary, St. Joseph.
6. <i>Carunculina parva</i> (Bar.).....	Lamp.	.175	.200	Semi-circular	Spineless	Evenly curved	Flat Cr., Sedalia.
7. <i>Eurydia brevicula brittsii</i> (Simp.).....	"	.250	.305	Semi-elliptic	Spineless	Undulate	Niangua R., Hahatonka.

nomenon. The physiologic preliminaries for ovulation have been noted by the writer on many instances in his detailed studies of two most accessible species of this State. It was found that the ovisacs were frequently distended with water before being filled with eggs, a reproductive function that may be necessary in all species in order that the ova may not be injured, that greater numbers may be admitted and that the laminae may be stretched to a thinness more suitable for the aëration of the embryos.

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#### A NEW OVULA FROM CALIFORNIA.

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BY S. STILLMAN BERRY.

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NEOSIMNIA CATALINENSIS, new species.

Shell very thin, fusiform, swollen above the middle, maximum diameter contained about  $2\frac{1}{2}$  times in the length; color a nearly pure porcelain or pearly white, the extreme ends tinted with brownish yellow for a distance of 2 to 3 mm. Surface polished and glossy; closely and finely longitudinally striate, the striae readily visible to the eye and rather irregular, a few being somewhat coarser than the remainder. Spiral sculpture comprising some 20-25 low cords at each end, becoming minutely wavy as they are intersected by the longitudinal striae; indications of an extremely faint wavy spiral striation over the rest of the shell are discovered by a strong lens. Shell pointed at both ends, but distinctly more produced at the apex than the base. Outer lip not greatly thickened, bordered by a narrow white callus; retracted at both ends, in each instance with an obscure angle. Columella sinuous; a low spiral fold and channel at the summit obliquely encircling the axis.

Length 23 mm.; maximum diameter  $8\frac{1}{2}$  mm.

Type: Cat. No. 1224 of the writer's collection.

Type Locality: 50 fathoms, off Avalon, Santa Catalina Island, California (Avalon Aquarium, August 1906).

Remarks: The type and a young specimen from the same locality taken by J. H. Paine in 1903 are before me. *N. catalinensis* does not seem to be very similar to any of the related



forms which I can find to have been described from this region. It is a more delicate and inflated species than either *variabilis* C. B. Adams or *vidleri* Sowerby, if I am correct in my determination of these forms, and not at all close to either. It seems to be nearest to the *O. barbarensis* Dall, but the latter is much more compact, more solid, and more highly tinted, as well as usually of considerably smaller size. While it is possible that the relatively thin callus on the lip is indicative of immaturity, another large specimen which has come to my notice from the San Pedro Channel agrees in this as in every other particular.

A figure will appear on a plate of this volume.

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#### THE CONJUGATION OF *ARIOLIMAX CALIFORNICUS*.

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BY HAROLD HEATH.

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The newly hatched young of *Ariolimax californicus* measure approximately five eighths of an inch in length, and under favorable conditions become from three to three and a half inches long at end of four months. Full-sized adults, measuring in the neighborhood of eight inches, probably reach such dimensions in not over ten months. A three-inch individual possesses all of the essential features of the adult, though the constituent organs of the reproductive system are of small size.

For several years the specimens of this species that are used for class dissection at Stanford University have been collected from a nearby and comparatively circumscribed area along the San Francisquito creek where the conditions throughout are uniform. It was therefore surprising to find that annually fully five per cent of the large-sized animals dissected in the classroom lacked the penis entirely, while in an equal number it was abnormally undeveloped when compared with that of smaller individuals which had not yet reached sexual maturity. As the years went by the conviction became stronger that at some previous time the penis in all such specimens had been cast off, and that its diminutive proportions in otherwise fully formed animals represented a regenerative stage.

To test the correctness of the hypothesis fully two hundred



animals were placed in an enclosure, and were fed for several weeks. Preliminary steps in the reproductive process (the so-called *Liebspiel*) were noted on several occasions, but evidently complete union never took place since no young were produced. More definite information, therefore, was sought in the field, but conjugation evidently takes place at night since on two days only—and those dark and gloomy in the early morning—was the act witnessed.

Prior to the act of conjugation each individual viciously bites the side of its mate (faced in the opposite direction), then violently retracts the head which gradually is protruded before the next onslaught. The intensity of this first phase gradually lessens as the bodies become curved about each other, thus finally bringing the genital papillae in contact. The penis of one individual only is then inserted, and after a period of several hours the two animals commence to draw apart. In both of the observed cases, when the penis had become exposed to the extent of about half an inch, one of the animals turned its head and commenced to gnaw upon the walls of the organ. These biting movements were unusually vigorous, and therefore in marked contrast to those witnessed during the feeding process but practically identical with those in the initial stages of conjugation, and within ten minutes had so scotched the penial walls that the exposed portion had stretched to an inch in length. The other animal (subsequent dissection in one case showed it to be the possessor of the intromittent organ concerned) now took part in the process, and within a very few minutes the penis was entirely severed.

All four of the animals were subsequently killed and dissected. In two of the individuals the gnawed-off penis extended from the genital pore through the proximal section of the oviduct to the distal, blind end of the seminal receptacle. The walls of the oviduct were in a high state of contraction, and only with the greatest care was it possible to dissect out the penis without destroying the surrounding tissue. In the other two specimens the penis was wholly absent, and the vas-deferens extended to to the genital pore—a condition of affairs exactly duplicated in some of the other animals examined on previous occasions in

the laboratory. As no other cases of conjugation were encountered it has not been possible to determine whether the penis regenerates or not, though I am firmly convinced that it does.

Whether this act of mutilation invariably takes place is not known, and the significance of the process is far more obscure. It is possible the amputated penis may act as a plug to retain the spermatozoa in the seminal receptacle, or on the other hand it may be that the presence of a human observer or some natural enemy brings with it unusual conditions, such as jarring the earth or some specific scent, and that the severing of the intro-mittent organ is a provision whereby the animals are enabled to separate more rapidly than usual. The fate of the penis is likewise unknown; it evidently is either absorbed or, what is more likely, is cast out before the eggs pass to the exterior.

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#### NOTES.

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POLYGYRA ALBOLABRIS MAJOR AND P. A. FUSCOLABRIS.—Clapp mentioned that you wanted to examine the animal of *Polygyra albolabris major* Binn. I happened to have one. So send it. The form ranges through Southern Alabama and I have found it as far north as Wetumpka. In Central and Northern Alabama the common large southern form of *albolabris* is pretty generally distributed, though not very common: some specimens approach *major* in size.

“The form which you called *P. albolabris fuscolabris* is as far as I know confined to the Cumberland Plateau and outlying masses (Monte Sano etc.) in Madison and part of Jackson Cos. Judging by the shells alone, I should be very much inclined to call this a distinct species. Ordinarily it is flatter than *albolabris* and always it can be easily distinguished by its peculiar luster as if varnished lightly: this is due to microscopic sculpture. Some of our specimens are larger than the average *major*. By the way, you must have had a specimen which was not quite mature: in full-grown shells the lip is white and the body of the shell is rather dark brown.”—HERBERT H. SMITH.

Having dissected the specimen of *P. a. major* sent, I find it identical with *P. albolabris* anatomically, and its status as a subspecies rather than a distinct species is therefore confirmed.—

H. A. PILSBRY.

# THE NAUTILUS.

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## NOTES ON THE WEST AMERICAN COLUMBELLIDÆ.

BY WILLIAM HEALEY DALL.

During the arrangement of the Columbellidæ from the West Coast of America in the collection of the National Museum it was found that a number of the names needed revision, and several other notes were made which may be useful to students pending the preparation of a general manual of the mollusks of this region.

The genus usually known as *Meta* Reeve, or *Conella* of H. and A. Adams (but not of Swainson), is in need of a new name, for Reeve's *Meta* of 1859 is preoccupied by Koch for a well-known genus of spiders since 1835. I propose for it the new name *Parametaria*.

The large series at my disposal shows that the differences used by Reeve to split up these shells into species are not of specific value, some specimens having a rounded, others an angulate or keeled shoulder; &c, &c. It is not improbable that there is really but one species. For it the earliest name is "*Conus*" *dupontii* Kiener, 1850, which will supersede Reeve's name of *cedonulli* given in 1859. It is positively known only from the Gulf of California and adjacent regions.

*Columbella festiva* Kiener, 1841 (not of De Laborde, 1830) from the vicinity of Cape St. Lucas and south to Panama, may take the name of *C. lucasana*.

*Columbella terpsichore* Sowerby, 1822, and *C. lyrata* Sowerby, 1832, are identical.

*Columbella (Anachis) parva* Sowerby, 1844, being preoccupied

by "*Buccinum*" *parvum* H. C. Lea, 1841, may take the specific name of *C. milium*.

*Columbella* (*Anachis*) *minima* Arnold, 1903 ; not of Tenison Woods, 1878, nor of Sacco, 1890, may be renamed *arnoldi*.

*Columbella* (*Anachis*) *guatemalensis* Reeve, 1859, and *tessellata* C. B. Adams, 1852 (not of Dunker, 1871) should be united with *C. lentiginosa* of Hinds, 1844.

*Columbella gaskoini* Carpenter, 1857, is identical with *C.* (*Anachis*) *taeniata* Philippi, 1846.

*Anachis petravis* Dall, 1908, proves to be identical with *A. subturrita* Carpenter, 1866.

*Nitidella cribraria* Lamarek, 1822, is preoccupied by Gmelin under the name of *ocellata*, 1792. *N. laevigata* Linné, 1758, and *N. dichroa* Sowerby, 1844, have been received by the Museum as from Panama, which I believe to be an error. Both are known to be Antillean. The latter is also *N. elegans* Dall, 1871, not of Adams, 1850.

*Nitidella incerta* Stearns, 1892, is probably to be referred to the subgenus *Alia*. *N. cervinetta* Carpenter, 1857, is identical with *N. baccata* Gaskoin, 1851.

*Nitidella dalli* E. A. Smith, 1880, is a synonym of *N. gouldi* Carpenter, 1857 ; but not of *Columbella gouldi* Reeve, 1858.

In 1870 I segregated from the heterogeneous species listed by H. and A. Adams under the name of *Astyris*, 1853, a group of three or four species to carry the name, of which *A. rosacea* Gould, 1840, was later selected by Fischer as the type. *C. clausiformis* Kiener, 1834, proposed as type by Tryon, 1883, belongs to the older genus *Aesopus* Gould, 1860, and cannot serve as type of *Astyris*.

The characteristic Californian group of bright-colored shells, which have been by the writer and others carried under the name of *Astyris*, should be included under the subgenus *Alia*, H. and A. Adams, 1853. *C. unifasciata* Sowerby, from Peru and Chile, is the type of *Alia*.

*C. gausapata* Gould, may be considered a good species, which ranges from Port Etches, Alaska, to San Diego, California. Under *carinata* Hinds, 1844, may be included as varieties *californiana* Gaskoin, 1852, and *hindsii* Reeve, 1858. These forms

are represented nearly over the range of the species which extends from San Francisco Bay, south to Salina Cruz, Mexico, and perhaps even farther.

*C. (Astyris) variegata* Stearns, 1873, is preoccupied by *C. variegata* Menke, 1828, and may take the specific name of *hypodra*.

*Nitidella filosa* Stearns, being preoccupied was called *Columbella stearnsi* by Tryon, 1883; it is referable to the genus *Aesopus*. A minute species four millimeters long, of a whitish color more or less tinged or spotted with brown, almost duplicates *Aesopus stearnsi* in form and sculpture, though so much smaller than the Florida species. I have named it *Aesopus myrmecoon*. It ranges from San Pedro, California, to Point Abreojos, Lower California. (U. S. Nat. Museum Cat. No. 105498).

The genus *Amphissa* H. and A. Adams, 1853, is characteristic of the Northwest Coast, and is typified by "*Buccinum*" *corrugatum* Reeve, 1846. But this is not the *Buccinum corrugatum* of Brocchi, 1814, and, since it is very abundant on the coast of British Columbia and in Puget Sound, it may take the name *columbiana*. It ranges from the Alaska Peninsula to San Pedro, California.

The *Amphissa bicolor* Dall, 1892, was unfortunately named. When fresh it presented distinct brown spiral bands on a pale olivaceous ground, but, as in many of the deep-water species, the coloration has not proved permanent and the banding is now hardly perceptible, the whole shell being of a light olive tint.

*Amphissa versicolor* Dall, 1871, ranges from Oregon to San Diego, with its metropolis apparently in the Bay of Monterey. There are several marked varieties: *cymata* Dall, with distinct brown axially waved lines on a white ground; *lineata* Stearns, 1872; *incisa* Dall, with sharply cut regular sculpture and beautifully mottled coloration (U. S. Nat. Mus. Cat. No. 223-294); and *reticulata* Dall, of a uniform whitish color, very acute spire, and fine regular corded spiral sculpture crossed by about 17 nearly straight axial narrow ribs. This form is usually in rather deep water, and ranges from Port Althorp, Alaska, to off San Diego, California in 62 to 183 fathoms. It is about the same size as *A. versicolor* but has a much more acute spire and

straighter axial ribs, and may prove on further study to be specifically distinct. (U. S. Nat. Mus. Cat. No. 210004).

*Columbella fusiformis* Hinds, 1844, is not the species so named by Anton, 1839, or Orbigny, 1844. It is a *Strombina* and may take the name of *fusinoidea*. It is a Panama species.

*Columbella subulata* Sowerby, 1847, is not *C. subulata* Duclos, 1840. It is a *Strombina* and may be hereafter called *S. colpoica*. It ranges from the Gulf of California to Panama.

*Strombina lilacina* Dall, is a short stumpy white species with an acute spire, the latter with a lilac flush in perfect specimens; the axial riblets are inconspicuous, but the spiral sculpture is of regular strong channeled grooves with wider flat interspaces, about nine on the last whorl; the distal end of the pillar projects beyond the outer lip, with a very deep recurved short siphonal sulcus; there is no dorsal hump, and the shell is about an inch long. (U. S. Nat. Mus. Cat. No. 219764). It has been received from the Gulf of California and Manzanillo.

Another species which seems to be undescribed, I propose to call *Strombina paccana*, as a tribute to the author of the excellent bibliography of the *Columbellidæ* in the fifth volume of the Proceedings of the Malacological Society, London. It is 37 mm. long. of which the spire takes 20, and the maximum diameter is 10.5 mm. There are more than ten whorls (nucleus lost); the spire is acute, with a narrow turriculation at the suture: the upper whorls are flattish and smooth, the last whorl and a half coronated in front of the suture by about nine small pustules. The shell is mostly dark brown with a silky periostracum. The aperture is narrow and edentulous, 15 mm. long. It has been obtained from Scammon Lagoon, L. Cal., and the Gulf of California. (U. S. Nat. Mus. Cat. No. 130616).

The word *Strombina* was used by Bronn in 1849 in a large sense to include *Aporrhaidæ*, *Strombidæ*, &c. According to the best usage this does not affect its use as a generic name. I have therefore not adopted the clumsy *Strombocolumbus* proposed by Cossmann in 1901 to replace *Strombina*. This author was probably misled by the brief entry in Scudder's nomenclator given to Bronn's *Strombina*. It may be added that the type of *Alia* is *C. unifasciata* Sowerby, selected by Chenu in 1859, not



*C. carinata* Hinds, as given by M. Cossmann; the type of *Amphissa* is *corrugata* Reeve, not *A. versicolor*; the type of *Meta* is *dupontii* Kiener, not *philippinarum* Reeve; Fischer's name for *Strombina bicanalifera* is *Bifurcium*, not *Bifurcina*, as per Cossmann; *Conidea* Swainson, 1840, is a synonym of *Pyrene* Bolten, 1798, but its type is *Buccinum punctatum* Bruguière, 1789, not *Columbella punctata* of Lamarck, Sowerby and others; the type of *Anachis* H. & A. Adams, 1853, is *scalarina* Sowerby, which is quite distinct from *rugosa* Sowerby, cited by Cossman; the type of *Atilia* is *suffusa* Sowerby, not *minor* Scacchi; these corrections have already been indicated by Mr. Pace, for the most part, and point clearly to the advisability of consulting original sources rather than relying on quotations by other authors.

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#### FRESHWATER SHELLS FROM CENTRAL AND WESTERN NEW YORK.

BY CARLOTTA JOAQUINA MAURY, PH.D.

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Some years ago the writer made extensive collections of molluscs from the lakes of Central and Western New York. The preliminary determinations of the species were verified by comparisons with specimens in the Say and Lea collections at Philadelphia and Washington; and doubtful cases were referred to Dr. Pilsbry, Dr. Dall, or Mr. Charles T. Simpson, who kindly passed judgment upon them. Thus every effort was made to make the identifications correct. Large numbers of individuals were obtained to observe the ranges of variation among the different species.

The writer presented the collection to the Museum of Cornell University where it is on exhibition.

From many of these lakes the mollusca have never been before recorded, nor have dredgings for deep-water forms been made except ours in Cayuga Lake.

It is also interesting historically that Say obtained several types from this region.

The mollusca were found to be most abundant in sheltered coves where the water is shallow and sun-warmed; and in the inlets and outlets of the lakes.



The following is a list of the species and the lakes in which they were found :—

*Lampsilis cariosa* Say. Cayuga Lake.

*Lampsilis iris* Lea. Cayuga Lake.

*Lampsilis luteola* Lam. Cayuga, Little York, Canandaigua, Chautauqua Lakes, Genesee River.

*Lampsilis luteola* var. *rosacea* DeKay. Cayuga Lake.

*Lampsilis radiata* Gmelin. Cayuga, Cayuta, Little York Lakes.

*Obovaria ellipsis* Lea. Niagara River (From Dr. Sager).

*Ptychobranchnus phaseolus* Hild. Chautauqua Lake.

*Strophitus edentulus* Say. Cayuga, Canandaigua, Green, Chautauqua Lakes.

*Anodonta cataracta* Say. Cayuga, Cayuta, Little York Lakes.

*Anodonta fluviatilis* Lea. Cayuga, Cayuta, Little York Lakes.

*Anodonta grandis* Say. Cayuga, Cayuta, Chautauqua Lakes.

*Anodonta grandis* Say var. *footiana* Lea. Canandaigua, Hemlock, Chautauqua Lakes.

*Anodonta grandis* Say var. *decora* Lea. Chautauqua Lake.

*Anodonta fragilis* Lam. Cayuga Lake.

*Anodonta implicata* Say. Cayuga Lake.

*Anodontoides ferussacianus* var. *buchanensis* Lea. (*Anodonta subcylindracea* Lea). Cayuga, Little York Lakes.

*Symphynota costata* Raf. (*Alasmodonta rugosa* Barnes). Cayuga Lake.

*Alasmidonta marginata* Say. (*Alasmidonta truncata* Wright). Tioughnioga River.

*Unio complanatus* Sol. Cayuga, Canandaigua, Little York Lakes.

*Unio gibbosus* Barnes. Chautauqua Lake.

*Sphaerium partumeium* Say. Fall Creek, Ithaca.

*Sphaerium simile* Say. Cayuga, Cayuta, Hemlock, Conesus, Chautauqua, Silver Lakes.

*Sphaerium striatinum* Lam. var. Chautauqua Lake.

*Sphaerium transversum* Say. Fair Grounds, Ithaca.

*Pisidium compressum* Prime. Cayuga Lake.

*Pisidium virginicum* Bourg. Hemlock Lake.

*Pisidium scutellatum* Sterki. Chautauqua Lake.

*Limnaea catascopium*, Say. Cayuga, Canandaigua, Chautauqua Lakes.

*Limnaea catascopium* white variety. Chautauqua Lake.

*Limnaea columella* Say. Cayuga, Conesus, Cayuta, Silver Lakes.

*Limnaea elodes* Say. Fall Creek and Cayuga Lake (Say's type locality).

*Limnaea elodes* var. *umbrosa*, Say. Conesus Lake.

*Limnaea emarginata* Say. Cayuga, Chautauqua Lakes.

*Limnaea humilis* Say. Dwyer's Pond, Ithaca.

*Limnaea stagnalis* Linn. var. *appressa*, Say. Fall Creek at Ithaca and Canandaigua Lake.

*Planorbis bicarinatus* Say. Cayuga, Cayuta, Canandaigua, Chautauqua Lakes.

*Planorbis bicarinatus* var. *major*. Fall Creek, Ithaca.

*Planorbis campanulatus* Say. Silver, Cayuta, Chautauqua, Conesus Lakes.

*Planorbis deflectus* Say. Fall Creek, Ithaca, Cayuga, Cayuta, Hemlock, Chautauqua Lakes.

*Planorbis exacutus* Say. Cayuga, Chautauqua Lakes.

*Planorbis hirsutus* Gould. Chautauqua Lake.

*Planorbis lentus* Say. Fair Grounds, Ithaca and Cayuga Lake.

*Planorbis parvus* Say. Cayuga, Chautauqua Lakes.

*Planorbis trivolvis* Say. Chautauqua, Canandaigua, Conesus Lakes and Glacial Kettle near Ithaca.

*Planorbis trivolvis* var. *corpulentus* Say.

*Segmentina armigera* Say. Cayuga Lake.

*Ancylus diaphanus* Hald. Cayuta Lake.

*Ancylus parallelus* Hald. Fall Creek, Ithaca and Cayuga Lakes.

*Ancylus rivularis* Say. Cayuga, Chautauqua Lakes.

*Physa ancillaria* Say. Owasco, Chautauqua Lakes.

*Physa gyrina* Say. Fall Creek, Ithaca.

*Physa heterostrophia* Say. Chautauqua Lake, Fall Creek at Ithaca, Courtland Pond.

*Pleurocera subulare* Lea. Cayuga Lake.

*Elimia virginica* Say. Cayuga, Conesus Lakes.

*Elimia virginica* var. *multilineata* Say. Cayuga Lake.

*Bythinia tentaculata* Linn. Cayuga Lake, Seneca River at Waterloo.

*Bythinella attenuata* Hald. Chautauqua Lake.

*Bythinella nickliniana*, Lea. Chautauqua Lake.

*Amnicola granum* Say. Chautauqua Lake.

*Amnicola limosa* Say. Cayuga, Chautauqua, Cayuta Lakes.

*Amnicola lustrica* Pilsbry. Cayuta Lake.

*Amnicola pallida* Hald. Chautauqua Lake.

*Valvata sincera* Say. Cayuga Lake.

*Valvata tricarinata* Say. Cayuta, Chautauqua, Owasco Lakes.

*Vivipara contectoides* Binney. Cayuga Lake.

*Campeoloma decisa* Say. Cayuga, Canandaigua, Conesus, Chautauqua Lakes.

After making this collection from the shallow waters of the lakes, the question naturally arose whether a deep-water molluscan fauna exists in Cayuga Lake.

To determine this, Professor G. D. Harris and the writer aided by Dr. Pilsbury, now of Ann Arbor University, made three dredgings from east to west across the lake between the Ithaca Lighthouse and Estey's Glen. A United States Fish Commission dredge, weighting about fifty pounds, with a net attached was employed. As the dredge was worked by hand power with a windlass, it was not feasible to go below about 200 feet. The maximum depth of Cayuga Lake is about 450 feet. This deep is in the middle of the lake at a point north-east of Tughanock Point (formerly known as Goodwin's Point), some miles north of our furthest section.

These dredgings proved very conclusively that molluscs are abundant from the shore line to about ten feet, after twenty-five feet they become very scarce, the dredge yielding only a few *Amnicolas* and broken fragments of shells, the occupants having apparently been preyed upon by fishes.

In the greater depths no signs of mollusca or of plants were found. There was only a very fine grey mud entirely barren of life.

We believe this to be due partly to the great depth of the Finger Lakes; but much more to the extremely low tempera-

ture of the water of Cayuga Lake, which even in midsummer is very cold except in sun-warmed shallows.

It is interesting to compare the present molluscan fauna of Cayuga Valley with its Pleistocene ancestry of which fossil remains<sup>1</sup> occur in a delta terrace between Toughannock Falls and Frontenac Beach, about twenty feet above the present lake level. These Pleistocene forms include:

- Lampsilis luteola* Say.
- Lampsilis ventricosa* Barnes.
- Anodonta fragilis* Lam., (*marginata* Say).
- Anodonta grandis* Say.
- Anodonta grandis* var. *footiana* Lea.
- Sphærium simile* Say.
- Pisidium compressum* Prime.
- Pisidium virginicum* Bourg.
- Limnæa palustris* Mull.
- Limnæa elodes* Say.
- Physa heterostrophæ* Say.
- Planorbis bicarinatus* Say.
- Planorbis deflectus* Say.
- Planorbis lentus* Say.
- Planorbis parvus* Say.
- Amnicola limosa* Say.
- Valvata tricarinata* Say.
- Campeloma decisa* Say.

These mollusca were approximately synchronous with the Pleistocene forms of the Don Valley beds of the Toronto formation, one-hundred and seventy miles northwest of Ithaca. They apparently lived during the Peorian, or Fourth Interglacial Period. The colony was established by Mississippian and St. Lawrence molluscs coming in from the West. After the annihilation of the colony by the advance of the ice, everyone of the interglacial species re-established itself when the ice finally retreated, and all are now living in the waters of Cayuga.

<sup>1</sup> See C. J. Maury, Interglacial Fauna in Cayuga Valley. Journ. of Geology, 1908, vol. xvi, no. 6, pp. 565-567.

## ON MONSTROSITIES IN CYPRÆA.

BY ST. G. BYNE, M. SC., F. L. S.

It will doubtless interest those who make a special study of the genus *Cypræa* if I enumerate some of the monstrosities which occur in the collections of myself, friends and museums. It is very remarkable that so many species inhabiting the Islands of New Caledonia should have their extremities pinched, and abnormally prolonged or rostrated. Many of these have had definite varietal names assigned to them by Dautzenberg and others. I have included dwarf adult specimens which seem to be especially abundant in the Andaman Islands judging by a large consignment which I have examined from that locality. One sometimes meets with shells which have been damaged and repaired by the animal.

*C. tigris* L. (a) A few examples from Sarawak abnormally flattened and gibbous. (b) Having a strong ridge running longitudinally over the dorsal surface. This seems to be due to one half being more thickly coated with calcium carbonate than the other. (c) Miss A. Foster of Bournemouth possesses two small unusually heavy examples. The dorsal surface is coated with a thick greyish-green enamel. The anterior extremities are pinched up and strongly rostrated.

*C. caputserpentis* L. Having a small dark brown protuberance upon the base.

*C. lurida* L. Two specimens from Naples whose extremities are curiously pinched and flattened out, and resembling New Caledonian forms.

*C. arabica* L. var. *niger* Roberts. This rare black variety from New Caledonia is well known to collectors.

*C. arabica* L. Mr. C. P. Richards of St. Ansell possesses in his collection a remarkable adult example, with greatly produced spire, the mouth reduced one third its normal length by some hard foreign substance being wedged in and coated over with enamel by the animal, thus altering the shape of the shell evidently to accommodate itself to the new conditions.

*C. histrio* L. Although many consider this to be a variety of *C. arabica*, yet I am of opinion that it should be raised to spe-

cific rank in future lists, as its differences in form and color are more than varietal. (a) very conical. Indian Ocean.

*C. moneta* L. var. *barthelymi* Bernardi. Having the extremities constricted and prolonged. A rare variety from New Caledonia.

*C. annulus* L. I cannot agree with those who consider this to be merely a variety of *C. moneta*, as the average specimen of each is so different in character. One can easily separate the varieties of *annulus* and *moneta* by the aid of the excellent descriptions by S. Raymond Roberts in Tryon's Manual Conch. vol. vii, pp. 177-8.

(a). A dwarf specimen in the Manchester Museum measuring 11 mm.

(b). var. *noumeensis*, Marie. Dautzenberg mentions a specimen from New Caledonia, in the Bordeaux Museum, 30 mm. long.

*C. caurica* L. This varies greatly in form from being long and narrow, to almost circular. A friend informs me that he has two hundred specimens all differing in shape and color. I have a specimen whose dorsal surface is decorticated so as to resemble that of a *C. tabescens*.

*C. caurica* L. var. *concava* Sowb. described in 1870, by Sowerby (from H. Owen's MSS) in his "Thesaurus Conchyliorum." Said to be from the R. Gambia, W. Africa. Is the locality correct for this Indian and Pacific Ocean species.

*C. caurica* L. var. *nana* Melvill. A dwarf form of var *oblongata*, Melv.

*C. erosa* L. var. *chlorizans*. An olive-green dwarf form (18 mm. long—Richards).

*C. erosa* L. Dwarf type specimen measuring 17 mm.

*C. lynx* L. var. *caledonica* Crosse. This well-known variety has the extremities pinched and extended, making the shell much narrower than the type.

*C. lynx* L. Having the aperture curiously widened out on one side.

*C. mauritiana*, L. (a). Frequently occurs extremely conical in shape. (b). Somewhat resembling *C. mus*, v. *bicornis* in having a distinct lump above posterior extremity. (c). A dwarf shell in my collection from the Andaman Islands measuring 48.5 x 32 mm. This is absolutely adult in every particular, and is probably unique.

*C. mus* L. var. *bicornis* Sow. In my experience there seem to be many intermediate forms between a good pronounced specimen of this variety and the type.



*C. stercoraria* L. (a) I have two dwarf specimens of the type measuring 33.5 and 35 mm. (b) Mottled with patches of a paler colour, the whole having a gangrenous appearance, caused by a disease of the mantle.

*C. stercoraria* L. var. *gibba* Gmel. More conical than the type and having the sides heavily flounced as in *C. arabica*, var. *reticulata*.

*C. arabicula* Lamarck. A fine example with the outer lip much extended beyond the posterior extremity.

*C. algoensis* Gray. A very pinched-up humped shell, quite an abnormality.

*C. umbilicata* Sow. A fine example in Mr. Richard's collection, 103 mm. long, with the outer lip extended into a curious flange on the anterior extremity.

*C. pantherina* Sol. (a) The outer lip so extended that the animal has contracted it into the shape of a letter V at the posterior extremity. (b) Having a proboscis-like protuberance projecting a quarter of an inch from the posterior end of the dorsal surface at an angle of forty-five degrees, probably caused by a barnacle. (c) Variety *theriaca* Melv. Having a large whitish callosity on the posterior end of the dorsal surface giving the shell a very remarkable appearance. (d) The base markedly convex, giving the shell a rocking-horse-like motion when the ends are pressed against a smooth surface. (e) The dorsal surface strongly corroded by a disease of mantle. Red Sea and Philippines. Some specimens of *C. tigris* collected by Mr. Stanley Gardiner in the Seychelle Islands are similarly attacked.

*C. exanthema* L. Abnormally flattened on dorsal surface. (Miss Foster).

*C. onyx* L. var. *adusta* Chemn. A specimen in the Manchester Museum has a barnacle attached, partly enameled over and colored like the rest of the shell.

Dautzenberg in his paper "Sur quelques deformations chez des Cypræa de la Nouvelle-Calédonie" in the Journal de Conchyliologie, vol. liv, has enumerated the following varieties, many of which are subject to melanism :

*neglecta*, L., var. *marteli*, Dautz.

*stolida*, L., var. *crossei*, Marie.

*mappa*, L., var. *montrouzieri*, Dautz.

*vitellus*, L. var. *subrostrata*, Dautz.

*errones*, L., var. *compressa*, Dautz.

*asellus*, L., var. *bougei*, Dautz. 31 mm. long !

*clandestina*, L., var. *marteli*, Dautz.

*punctata*, L., var. *rostrata*, Dautz.

*cribraria*, L., var. *rostrata*, Dautz.

*erosa*, L., var. *protracta*, Dautz.



# THE NAUTILUS.

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## ADDITIONAL RECORDS OF MOLLUSCA FROM SAN BERNARDINO COUNTY, CALIFORNIA.

BY S. S. BERRY.

Deferring for the present any attempt to revise the list published some years ago (NAUTILUS, vol. 23, pp. 73-79, Nov., 1909), it may be desirable to record the following additional species from my rapidly-accumulating notes on the mollusks of San Bernardino County. A few of these are new to California, while one or two are reported for the first time from the Pacific drainage as distinguished from that of the Gulf of California.

VALLONIA CYCLOPHORELLA Ancey.

Mill Creek Canyon, alt. 4600-5000 feet (S. S. B., July, 1910).

HELIX ASPERSA Müller.

I have not seen this European garden pest in Redlands until the present season, when some specimens were handed me by W. F. Chance. It is already abundant in certain parts of the city, notably in gardens on Olive and Palm Avenues.

VITREA ALLIARIA (Miller).

Walnut Avenue, Redlands (A. G. Smith and S. S. B., Jan., 1914, etc.), abundant.

VITREA MILIUM PUGETENSIS (Dall).

Waterman Canyon (A. G. Smith, Jan., 1914). Probably identical with the Redlands specimen previously reported as *milium*. The specimens agree with the description of *V. m. meridionalis* Pilsbry and Ferriss, but except for their slightly

larger size do not seem very different from Seattle specimens of *pugetensis*.

BIFIDARIA PENTODON (Say).

Mill Creek Canyon, alt. 4600 feet (1 specimen, S. S. B., July, 1910).

BIFIDARIA HEMPHILLI Sterki.

Waterman Canyon (S. S. B., Nov., 1913). This species does not seem to have been reported previously north of San Diego. It is a common form in this canyon.

VERTIGO MODESTA PARIETALIS Ancey.

Common in Bluff Lake Meadow, alt. 7550 feet (S. S. B., July, 1910), and other alpine cienagas.

VERTIGO MODESTA CASTANEA Sterki.

Holcomb Meadows, east of Sugarloaf Peak, at altitude of 8300 feet (S. S. B., Aug. 18, 1913).

VERTIGO OVATA (Say) var.

Mill Creek Canyon, alt. 4600 feet (S. S. B., July, 1910).

PUNCTUM CONSPECTUM PASADENÆ Pilsbry.

Walnut Avenue, Redlands (S. S. B., Jan. 21, 1916).

AGRIOLIMAX CAMPESTRIS OCCIDENTALIS Cooper.

Cienagas above Bear Lake, alt. about 7000 feet (S. S. B., Aug., 1910). Determined by Mr. Vanatta.

SUCCINEA STRETCHIANA Bland.

Should replace the name *S. oregonensis* in my former lists.

ANCYLUS sp.

Prospect Park, Redlands (A. G. Smith, Dec., 1910); roadside pool, near San Bernardino (S. S. B., Aug., 1911). A small species which it is not yet possible to identify satisfactorily with any of the named forms. I have not chanced upon any previous records of this genus for the entire southern sector of California.

PLANORBIS OPERCULARIS Gould var.

Marsh at Knight's Ranch, Bear Valley, alt. 6750 feet (Mrs. Kate Stephens, Aug., 1903). The specimens are not typical. According to Dall's synopsis of the races of *opercularis* in his Land and Fresh Water Mollusks of the Harriman Alaska Ex-

pedition, they would possibly come under *centervillensis* Tryon.  
*GONIDEA ANGULATA* Lea var.

Chino Creek, near Ontario (R. H. Tremper, April, 1911). The specimens are somewhat like a small form of *G. a. haroldiana* Dall, but are more produced in front.

*PISIDIUM ROPERI* Sterki.

Abundant in Dry Lake, north slope of San Gorgonio Mountain, alt. 9050 feet (S. S. B., Aug., 1913). The specimens were determined by Mr. Vanatta. Those from lower altitudes previously reported as *P. californicum* Newcomb MS. are perhaps the same.

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#### THE ANATOMY OF *LEMIOX RIMOSUS* (RAF.).

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BY A. E. ORTMANN.

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*LEMIOX RIMOSUS* (Rafinesque) 1831 = *MICROMYA CÆLATA* (Conrad) 1834. See: Simpson, Synops. Nai., 1900, p. 525, and Descr. Catal. Nai., 1914, p. 34.

*Lemiox rimosus* Frierson, NAUTILUS, 28, 1914, p. 7.

I collected this species at the following localities: Holston River, Turley Mill, Grainger Co., and Mascot, Knox Co., Tenn.; North Fork Holston River, Hilton, Scott Co., Va., and Rotherwood, Hawkins Co., Tenn.; Clinch River, St. Paul, Wise Co., Va., and Clinton, Anderson Co., Tenn.; Powell River, Combs, Claiborne Co., Tenn. At the latter locality, a gravid female was found on Sept. 12, 1913 (with glochidia).

Anal and supraanal openings separated by a moderately long mantle connection, which is somewhat shorter than the anal, and considerably shorter than the supraanal. Anal with fine papillæ, branchial with large papillæ. Palpi with the posterior margins connected at base only. Gills of the usual Lampsiline structure; inner lamina of inner gills entirely connected with abdominal sac, but often there is a short slit posteriorly (not more than one-fourth of the length of the abdominal sac).

Marsupium of the Lampsiline type, located in the posterior section (less than one-half) of the outer gills, kidney-shaped;

leaving a small posterior part of the gill non-marsupial. There are about 12 ovisacs on each side in my gravid female.

In the female, the mantle margin in front of the branchial opening has the inner edge nearly parallel to the outer. The outer edge is denticulate posteriorly (corresponding to the denticulate margin of the shell). The inner edge has, just in front of the branchial, a few small papillæ, and then it is lamellate and elevated, and rather smooth. Farther in front, there are again a few small papillæ. This differentiated part of the inner edge reaches nearly to the middle of the lower margin. The lamellar elevation is very distinct, and sharply defined from the anterior and posterior papillate part, and is slightly longer than either of them, and, in the specimen at hand, somewhat thickened, with a blunt edge (of course, the specimen is contracted by the action of the alcohol; it is probable that this edge was capable of some sort of expansion). In the region of the lamella, the inner edge of the mantle is farthest remote from the outer, but not much so, and there is no sudden drawing apart of the mantle edges (as in the genus *Truncilla*).

In the male, the female structure of the inner mantle is indicated in a rudimentary condition: the papillæ are extremely small, and the smooth lamellar part is present, but thin and hardly elevated.

Color of the soft parts whitish. Edges of mantle brownish, blackish in the region of the anal and branchial, and the outer edge is spotted black and brown in this region, chiefly in the female. A black streak runs along the inside of the inner edge in front of the branchial, extending, in the female, upon the lamellar elevation, which is entirely black. Edge of marsupium pale (without black pigment).

Glochidia subovate, higher than long. L. 0.21, H. 0.26 mm.

The genus *Lemiox* is a Lampsiline form with very peculiar shell characters, the most remarkable of which is the sculpture of the posterior part of the shell by rugose wrinkles, which produce, in the female, a distinctly, but irregularly, denticulate or scalloped margin of the shell. The postbasal expansion of the female shell is rather small, but distinct, and corresponds, in its location, to the lamellar expansion of the inner mantle edge.

Beak sculpture distinctly double-looped, consisting of three to four bars, the first one or two bars subconcentric. According to the soft parts, this genus belongs in the group of *Lampsilinae* which have a differentiated mantle edge in front of the branchial; but with regard to the particular structure of this edge, it is unique, in having papillæ as well as a short, elevated lamella. It is not very closely allied to *Lampsilis*, which has a large and long mantle flap, but stands nearer to the *Eurynia*-type, and possibly most closely to *Carunculina* (recte: *Toxolasma* Raf.), and we might regard the short lamella of *Lemiox* as analogous (or possibly even homologous) to the "caruncle" of *Carunculina*. But it cannot be united with the latter on account of the shape of the lamella, and the sculpture of shell and beaks (it differs also by the nearly complete connection of the inner lamina of the inner gills).

Simpson placed the species with *Micromya* (now a subgenus of *Eurynia*), but the structure of the mantle edge as well as the shell is distinctly different.

There is no question that this form should be regarded as the representative of a distinct generic type, *Lemiox*, and that it should be placed in the vicinity of *Eurynia* and *Toxolasma* (= *Carunculina*).

In the denticulations of the edge of the shell, there is some resemblance to the genus *Truncilla*, but there is no considerable space between the edges of the mantle, as in that genus, and also in other characters, *Lemiox* is entirely different from *Truncilla*.

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#### NEW SUBSPECIES OF VIVIPARUS AND CAMPELOMA.

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BY H. A. PILSBRY.

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#### VIVIPARUS CONTECTOIDES IMPOLITUS n. subsp.

The shell is heavier than *confectoides*, rough and with irregular growth-lines and wrinkles, and often somewhat malleated; shoulder more conspicuous; and on the last whorl the bands are obsolete. The umbilical perforation is very narrow or closed. Length 39, diam. 31.5 mm. Type no. 66701 A. N.

S. P., collected by H. E. Sargent in a marsh on the Paint Rock River, Jackson Co., Alabama.

VIVIPARUS CONTECTOIDES COMPACTUS n. subsp.

The shell is compactly coiled, imperforate; whorls a little less inflated than in *conectoides*. Length 27.5, diam. 20.5 mm. Type no. 27731 A. N. S. P., from Dougherty, Georgia. Also from Chetachee creek, Ala., both lots from the Wheatley collection.

CAMPELOMA RUFUM MERIDIONALE n. subsp.

The shell is short, solid, dull citrine, paler at the shoulder; surface having fine growth-lines as usual, crossed by many weak, minute and crowded spiral striæ. *Spire shortly conic*, the summit eroded. Last whorl strongly shouldered, the shoulder narrow; *very convex in the peripheral part*. Aperture large, brown within in the upper two-thirds. Lip slightly sinuous. Columellar callus moderate.

Length 29.3, diam. 20.3, length of aperture 17.8 mm.

Length 29, diam. 21.3, length of aperture 18.2 mm.

North Carolina: Little Sugar Creek; Crozier's Branch, Cabarrus Co. (type loc.), also Georgia. Type 122781 A. N. S. P.

Distinguished by its short, obese shape and distinct striation.

CAMPELOMA RUFUM GENICULIFORME n. subsp.

This race is like the preceding in color and sculpture, but differs in outline. The spire is elevated, and the whorls have a broad, horizontal shoulder, below which the wall is nearly vertical, as in typical *C. genicula* (Conrad). It differs from *genicula* by the brown color in the mouth and on the eroded summit.

Length 31.5, diam. 20.4 mm., length of aperture 16.8 mm.

Dooley Co., Georgia. Type 122782 A. N. S. P.

CAMPELOMA FLORIDENSE (Call).

"*Campeloma floridense* Call MS." (as synonym of *C. limum*), Call, Bull. Washburn College Laboratory of Natural History, vol. 1, No. 5, p. 159, 160, pl. 6, fig. 7 (May, 1886).

This species was mentioned as a MS. name under *Campeloma limum* by Mr. Call, who apparently had not seen the true



*Paludina lima* Anth., as his description does not fit it, being partly drawn from the Florida species, partly compiled from Anthony.

The shell has a rather short spire and large aperture, it varies on different parts of the same specimen, and in different specimens from dark citrine to blackish brown. *The interior is chocolate, chestnut-brown or dark indian-red*; the invariably dark color being highly characteristic. The surface has unequal, minute, spiral striae. The last whorl is somewhat compressed below the narrow subsutural shoulder. Columella rather heavy, nearly white. A large specimen measures, length 34.6, diam. 22.3, aperture 19.8 mm., 4 whorls remaining.

So far as known, this species is restricted to the St. Johns River and tributary creeks, in Florida. Mr. Johnson and the writer dredged it in Lake County. It is one of the most distinct species, owing to its color.

*Campeloma limum* (Anth.) is a more slender, green species with a smaller mouth, bluish within, and a more or less distinctly subangular periphery. *Melantho decampi* W. G. Binney is a synonym of *C. limum*.

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### THE RAFINESQUE-POULSON UNIOS.

BY BRYANT WALKER.

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In publishing the complete list of the Rafinesquean Unios in the Poulson collection with their modern equivalents, Mr. Vanatta has rendered a distinct service to all students of the American Naiades. Now, for the first time, we, to whom the specimens are inaccessible, are informed exactly as to which of the species familiar to us under Simpsonian designations are represented in that famous collection and their names as identified by Rafinesque himself.

While, with a single exception, it is not claimed that these are the original types of Rafinesque's species, and it is explicitly stated that the ultimate recognition of any of Rafinesque's species "depends upon whether it could be identified by descriptions published prior to any other recognizable name for

the same species," nevertheless it is a distinct advantage to know exactly what Rafinesque in 1831 understood or claimed to be the species that he had described in 1820.

The author has presented a tentative synonymy of the species represented in the Poulson collection, "if they were recognized and the names dated from 1820." In this suggested arrangement, Rafinesque's genera and subgenera are ignored and all of his species are treated as *Unios* and synonymy is based entirely on the supposition that they were described as *Unios*.

In this, the author seems to have overlooked Rafinesque's explicit statement, (p. 298), as to his method of compiling his Monograph.

In 1819, Rafinesque had proposed to divide the North American *Unios*, "provisionally," into eight subgenera. In 1820, in his "Monographie," after referring to this fact he says:

"Since then, having increased my species and verified their characters, it appears to me to be proper to make from them many genera and subgenera, but to humor ("pour complaire") naturalists, who might hesitate to adopt the changes in nomenclature that the discoveries necessitate, I will give the name of *Unio* in the second place to all new species, observing to those, who would assign them all to the genus *Unio*, which thereby would contain more than seventy species, that it would be necessary in the description of the specific characters to repeat those of my new genera, this would render the definitions of the species long and prolix."

In accordance with this statement, throughout the Monographie he first prints *his* name for the species in italics and then, "pour complaire," adds in parenthesis and in Roman type the popular or conventional name.

If, instead of adopting this system, he had in every instance stated in his explanatory remarks that for those who did not adopt his new genera the species would be an *Unio*, there could be no possible doubt of his intention to use his new generic terms. And, in view of his explicit statement, I do not see how any other inference can be properly drawn from the method that he did adopt. There is not to be found anywhere in the Monographie the slightest intimation that he had ever

any doubt as to the correctness of his new classification or that in any degree he intended to impugn its validity.

If I am right in this contention, much of the tentative synonymy proposed by Mr. Vanatta will have to be reviewed.

In view of the fact that the adequacy of Rafinesque's original descriptions is expressly left in abeyance, it would seem to be better to retain the Simpsonian names until all of those questions can be definitely determined.

Expressly reserving, therefore, all questions relating to the adequacy of Rafinesque's original descriptions and simply to determine "the effect on nomenclature if they were recognized and the names dated from 1820," taking the species in the order given by Vanatta, it would appear to be necessary to make the following changes :

*Truncilla brevidens* Lea.

Described by Rafinesque as *Obliquaria interrupta*. It is not, therefore, preoccupied by *Unio solenoides interrupta* and, if identifiable, would take precedence over Lea's name.

*Truncilla sulcata* (Lea).

*Unio sulcatus* Lea (1830) is not preoccupied by *Pleurobema mytiloides sulcata* Raf. (1820). But *Obliquaria obliquata* Raf., if identifiable, would have priority.

*Plagiola securis* (Lea).

*Obliquaria depressa* Raf. (1820) is not preoccupied by the *Unio depressa* Lam. (1819). But both Say (1834) and Conrad (1834) have given preference to *lineolata* Raf. over *depressa* Raf., although the latter has page precedence. This they had the right to do under the Code and, if identifiable, Rafinesque's name will take precedence over Lea's.

*Plagiola elegans* (Lea).

*Truncilla truncata* Raf. (1820) is not preoccupied by *Unio truncata* Spengl. (1793). If identifiable, Rafinesque's name has priority over Lea's. *Metaplata* Raf. is subsequent to both.

*Tritogonia tuberculata* Bar.

*Unio tuberculata* Bar. (1823) is not preoccupied by either *Obliquaria tuberculata* Raf. or *Obovaria striata tuberculata* Raf. (1820). But *Obliquaria verrucosa* Raf., if identifiable, has priority for the species.

*Cyprogenia irrorata* (Lea).

*Obovaria stegaria tuberculata* Raf. is not preoccupied by *Obliquaria tuberculata* Raf. But *Obovaria striata tuberculata* has page precedence. If identifiable, *stegaria* Raf. (1820) has priority over *irrorata* Lea (1830) as the specific name.

*Unio gibbosus* Bar.

Barnes' name (1823) is not preoccupied by *Amblema gibbosa* Raf. (1820). But *Unio dilatata* Raf. (1820), if identifiable, has priority.

*Unio pusillus* Lea.

*Obliquaria pusilla* Raf. (1820) did not prevent the use of *pusillus* for a *Unio* by Lea in 1840. Lea's name will, therefore, stand.

*Quadrula lachrymosa* (Lea).

Simpson did not separate *asperrima* Lea varietally from *lachrymosa* as Vanatta's remark would indicate. If identifiable, Rafinesque's name, *quadrula*, has priority and would become the specific name and, if separable varietally, *lachrymosa* Lea would become a variety.

*Quadrula pustulosa* (Lea).

*Obliquaria retusa* Raf. (1820) is not preoccupied by *Unio retusa* Lam. (1819). If identifiable, Rafinesque's name would have priority over Lea's.

*Quadrula subrotunda* (Lea).

*Unio subrotunda* Lea (1831) is not preoccupied by *Obliquaria subrotunda* Raf. (1820). However, *sintoxia* Raf. (1820), if identifiable, has precedence over *subrotunda* Lea.

The statement that "many of Rafinesque's species have been credited to Conrad by Mr. C. T. Simpson" is hardly fair to the latter. Conrad did sufficiently describe and figure a considerable number of species in his "Monography" of 1836, which he credited to Rafinesque. At least one of these, *U. cordatus*, does not agree with the specimen under that name in the Poulson collection as identified by Vanatta. Simpson states expressly that he had made careful and repeated attempts to identify Rafinesque's species and that, while he found quite a number that should be recognized and which he did recognize, as to the remainder he was "utterly unable to make anything

out of them." Having reached this conclusion, the only thing that he could do was to credit the species described in the Monography under these indeterminable names to Conrad.

The list of names proposed by Rafinesque and not mentioned in Simpson's Synopsis is also misleading. Of the twenty-three "Unios" listed, only three were described as distinct species of *Unio* by Rafinesque: eight are varieties of certain species of *Unio*, while the remaining twelve are made up of one species and eleven varieties described under various different generic names. It would certainly have been better if Simpson had given a complete list of all of the species named by Rafinesque as long as he attempted to compile such a list at all. But the value of quoting indeterminable species is questionable and so far as nomenclatorial purposes are concerned, they are practically *nomina nuda*.

In conclusion, Mr. Vanatta proposes new names for three species described by Lea and Conrad under names supposed to be preoccupied by Rafinesque.

One of them, *Pleurobema simpsoni*, proposed for *Unio striatus* Lea seems unnecessary as Rafinesque's *striata* was described as an *Obovaria* and not as an *Unio*.

If Rafinesque's *Unio nigra* and *Unio viridis* are identifiable, the other two changes proposed are proper under the Code.

These changes are but a foretaste of what is likely to happen to very many of the familiar names used for our American species, when the thankless and interminable task of collating all of the varietal names used for the *Unionidae* from the beginning has been completed and the unnecessary and vicious provisions of the Code in regard to the standing of varietal names is enforced according to the letter of the law.

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#### A NEW TEREDO FROM THE WEST COAST OF AMERICA.

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BY PAUL BARTSCH.

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In looking over the West American Teredinidae in the collection of the U. S. National Museum, I find an undescribed species from the San Diego region which may be called :

TEREDO DIEGENSIS new species.

Expanded portion of pallets ovate, tipped at the distal end, which is the smaller, by a thick black distally truncated corneous cap. A complete description and illustration of the shell, which is like typical *Teredo*, will follow shortly in a monograph on the American species of this family.

There are six lots of this species in the collection of the U. S. National Museum from San Diego, California. The type is registered under Cat. No. 74219 U. S. N. M.

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#### NOTES.

BIFIDARIA CLEMENTINA OLDROYDAE, N. VAR.—Shell similar to *B. clementina* St., but it lacks the basal fold. The angular lamella has a transverse depression, which gives it a double appearance in the face view. Length 1.9., diam. .9 mm. From Santa Barbara Island collected by H. Hemphill in October 1902. The type is No. 113848 Acad. Nat. Sci. Phila., donated by Mrs. Ida S. Oldroyd, in whose honor it is named.—E. G. VANATTA.

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VIVIPARUS MALLEATUS Reeve.—In the NAUTILUS, Vol. 19, p. 35, July 1915 I published a note on the occurrence of this species in Massachusetts. That the colony is still thriving is shown by Messrs. Wm. J. Clench and Kendall Foster who obtained over 50 specimens this spring, varying from 10 to 45 mm. In cleaning one of the larger specimens I obtained from the oviduct a specimen measuring 6 mm.—C. W. JOHNSON.

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#### PUBLICATIONS RECEIVED.

THE PLIOCENE MOLLUSCA OF GREAT BRITAIN. By F. W. Harmer F. G. S. Part II, pgs. 201–302. (Palaeontographical Society 1914). This part contains the Pleurotomidae. A number of new species are described and all of the species are figured on seven plates.







PLEURODONTÉ TORREI HENDERSON.

# THE NAUTILUS.

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## A NEW CUBAN ZACHRYZIA.

BY JOHN B. HENDERSON.

PLEURODONTE (ZACHRYZIA) TORREI n. sp. Pl. I.

Imperforate, depressed, solid, straw color with russet streaks strongly arched forward, darker just behind the aperture. Four whorls, first  $\frac{1}{2}$  subtly spirally lirate and then malleated; the rest finely costulate striate, the striae arching forward and becoming wavy and complicated on the last whorl, and especially in the peripheral region, by two sets of revolving striae, one microscopically fine, giving under the lens a wrinkled appearance. There is a smooth shining area about the base. Last whorl abruptly descending in front, strongly carinated, the carina directed upward, so that the whorl is concave above and convex below except in the last  $\frac{1}{4}$  whorl, where the carina is less obvious and the whorl becomes swollen and convex above. The outline of the final  $\frac{1}{4}$  whorl is nearly straight, and bulges out into a gibbous ring about the aperture. Aperture small, very oblique, truncate oval. Peristome thickened, slightly expanded, white; basal margin horizontal, nearly straight, forming an obtuse angle with the curved outer lip; obsoletely toothed near the insertion of the columella.

Major diam. 31; min. diam. 25; height 17; ap. (inside) 11 by  $8\frac{1}{2}$  mm.

Locality: Farallones de Canipu, "Cayo del Rey" in the Mayari hills of Oriente Province, Cuba.

The shell has a lop-sided appearance, attenuated on the left, and swollen on the right side. The peculiar shape suggests a

deformity ; but many specimens taken without other forms or variation preclude such conclusion. The species is more closely comparable with *P. quantanamensis* and *P. proboscidea* than with any other of the group ; but from these it is separable by the revolving sculpture and the up-tilted carina. It is the only carinated *Zachrysia* yet observed.

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#### THE ANATOMICAL STRUCTURE OF GONIDEA ANGULATA (LEA).

BY A. E. ORTMANN.

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The specimens at hand belong to the var. *haroldiana* Dall (Smithson. Misc. Coll. 50, 1908, p. 499; Hannibal, Proc. Malacol. Soc. London 10, 1912, p. 127, pl. 6, f. 10 ; Simpson, Descript. Cat. Nai., 1914, p. 466). They have been collected by H. Hannibal in Coyote Creek, Milpitas, Sta. Clara Co., California, partly on March 31, 1913, and partly in June, 1913. Over two dozen were received, among them males, sterile and gravid females.

*Anal* and *supraanal openings* separated by a well-developed mantle-connection, which is about  $\frac{2}{3}$  as long as the anal, and about half as long as the supra-anal. Inner edge of anal with fine papillae. *Branchial opening* separated from the anal by the gill-diaphragm, its inner edge with large papillae ; branchial well defined anteriorly by the sudden disappearance of the papillae.

*Palpi* subfalciiform, their posterior margins connected for about the half of their length.

*Gills* long and broad, the inner the broader. Outer gill gradually narrowing in front, its anterior end at the highest point of the line of attachment of the mantle, quite distant from the palpi. Inner gill narrowing more suddenly, and its anterior end about midway between palpi and anterior end of outer gill or at two thirds of this distance, but there is always a space behind the palpi. Outer lamina of outer gills entirely connected with mantle. Inner lamina of inner gills free from abdominal sac, except at its anterior end. Behind the foot, the two inner laminae of the inner gills are connected. Thus the gill-diaphragm is complete.

Gills with *well-developed septa*, running parallel to the gill filaments and forming water tubes. However, the septa are not all continuous, *but are often interrupted*, chiefly so toward the proximal (basal) part of the gill, and, toward the edge, frequently shorter septa are intercalated. In the female, *all four gills have marsupial structure*: the septa are much heavier and more closely set than in the male; this structure is most evident in the central parts of the gills, while at the anterior and posterior ends it resembles more that of the male. The heavy septa in the middle of the gills of the female are frequently *perforated by subcircular holes*, so that here the interruptions of the septa assume a rather regular arrangement.

When gravid, all four gills of the female are charged. The gills, when fully charged, are only slightly swollen, with edges remaining sharp, and often there are no ova at the ends of the gills, chiefly the anterior end. The outer gills are charged first, and thus there are some individuals in which the inner gills have *not yet* received ova. The ova only incompletely stick together in the shape of placentae, and easily fall apart.

*Glochidia* moderately large, subovate or nearly subcircular: they represent, in outline, a segment of a circle cut off by the hinge line; but the circle is not regular, being more narrowly rounded in the middle of the ventral margin. There is no trace of hooks. Valves of the glochidium rather strongly convex. Length and height about equal, 0.19 mm.

None of the gravid females collected on March 31 had glochidia, but such were present in some specimens collected in June. This, and the additional facts that in some females the gills were not yet fully charged in March, and that some were discharged in June, demonstrate that the beginning of the breeding season falls at the end of the month of March and that it lasts at least till June: a rather unusual time in North-American *Nayades*.

*Color* of soft parts grayish or brownish white, without any marked or characteristic tints.

This species originally was described as an *Anodonta*, and Simpson (1900 and 1914) placed it in his group of *Homogenae*, which largely (with the exception of the last three genera)

corresponds to my subfamily *Anodontinae* (Ortmann, Naut. 23, 1920, p. 117 and Ann. Carn. Mus. 8, 1912, pp. 224 and 278). However, *it does not belong here at all*. It is true, the rudimentary condition of the hinge suggests its affinity with the *Anodontinae*, and what Simpson knew about the anatomy did not conflict with this. But the material at hand proves conclusively that none of the characters of the *Anodontinae* are present. It is, indeed, a member of the family *Unionidae* (as defined by myself l. c.), for it has a complete diaphragm formed only by the gills; it has a supraanal opening; the gills have septa and water tubes running parallel to the gill filaments. However, the facts, that all four gills are marsupial; that the charged gills are only moderately swollen, with sharp edges; that no system of secondary water canals is developed within the gills; and that the glochidia are not triangular and have no hooks, *place Gonidea with the subfamily Unioninae*.

Within this subfamily, the genus has quite an isolated position, offering a curious mixture of primitive and advanced characters. The most primitive features are, that *all four gills are marsupial* in the female, and the *interrupted character of the septa*. This latter character is quite unique, suggesting even the ancient family of the *Margaritanidae*. The rather long mantle-connection between anal and supraanal openings does not agree with the more primitive types of the *Unioninae* (*Fusconaia* etc.), but rather with the more advanced ones (*Unio*, *Elliptio*), while the rudimentary condition of the hinge again is unique in the subfamily, exhibiting an advanced condition, which is not known, except in the genus *Lastena* (see Naut. 28, 1915, p. 106). The simple beak sculpture (4 to 5 subconcentric bars) appears as primitive. The glochidia are also of a primitive shape, agreeing with the shape generally found in *Unioninae*.

Hannibal (Science, 36, Dec. 20, 1912, p. 865) has suggested an amended division of the *Nayades* into families and subfamilies. I am not prepared to accept this as proposed, but I believe we shall be finally compelled, chiefly for the sake of convention, to follow his fundamental idea, namely that my subfamilies (*Unioninae*, *Anodontinae*, *Lampsilinae*) should rank as families. Then my *Unioninae* would become *Unionidae* (not



*Quadrulinae*, as Hannibal proposes, for I emphatically want to retain the European *Unio* in this group), and certain groups of my “*Unioninae*” should be elevated to the rank of subfamilies. Of the genera treated by myself in 1912 (l. c. p. 239, 240), eight (*Fusconaia* to *Uniomereus*) should form the subfamily *Quadrulinae*; the European *Unio* should form the subfamily *Unioninae*, and *Parreysia* and *Lamellidens* probably should form a third subfamily. In addition, another new subfamily should be erected for the present genus, that of the *Gonideinae*, with the characters of shell and soft parts as indicated above.

However, I refrain at present from working this out in detail, since there are yet many, chiefly exotic (Asiatic) genera, which require further study.

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#### A NEW LANDSHELL FROM BRAZIL.

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BY PAUL BARTSCH.

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Among a lot of shells collected by Mr. H. M. Curran on the Rio Grungugy, Bahia, Brazil, is an *Oxychona* which differs from any of the described forms, and which I take pleasure in naming after the discoverer :

*OXYCHONA PYRAMIDELLA CURRANI.* New subspecies.

The shell strongly suggests *Oxychona pyramidella* (Wagner) described in his *Testacea Fluviatilia Brasiliana*, page 22, plate 16, figures 1 and 2, 1827, but differs from it by having the spire entirely white. The lip of our shell is of old-rose color while the broad basal band, which terminates a little before reaching the aperture, is liver-brown with a glaucous suffusion. The basal band is about one-third of the width of the base and is separated from the peripheral angle by a narrow white zone about one-fourth the width of the brown band. Our shell has seven whorls and measures : height 18.4 mm., greater diameter 22 mm., lesser diameter 18.6 mm.; the aperture measures from the columella to the outer angle of the keel 12.5 mm., from the columella to the posterior angle 6 mm. The type is Cat. No. 322281 U. S. N. M.

I am greatly indebted to Dr. H. A. Pilsbry for comparing our specimen with material in the collection of the Academy of Natural Sciences of Philadelphia.

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STUDIES IN NAJADES.

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BY A. E. ORTMANN.

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(Concluded from Vol. 29, page 67.)

EURYNIA (MICROMYA) ARKANSASENSIS (Lea). (See: *Lampsilis ark.* Simpson, 1900, p. 557).

Three males and three sterile females from Saline River, Benton, Saline Co., Ark., collected by H. E. Wheeler, July 13, 1911.

Mantle-connection between anal and supraanal moderately long, but shorter than either opening. Anal with distinct or indistinct crenulations. Branchial with papillae. In front of branchial, the inner edge of the mantle is slightly lamellar in the female, with a series of about a dozen very small, rather distant, and somewhat irregular papillae, accompanied by a streak of black pigment. These papillae are smaller than those of the branchial opening, and are most distinct anteriorly. They are smaller than those of *vanuxemensis*, but agree very nearly with those of *constricta*. In the male, the streak of black pigment is present, but the papillae are represented by mere crenulations.

Posterior margins of palpi connected at base. Inner lamina of inner gills entirely connected with abdominal sac. Marsupium of the sterile female with 20 to 25 ovisacs, its edge pale brownish.

This species also in the shell resembles *E. vanuxemensis* and *constricta*, but it is more swollen and has more anterior beaks. The female has the characteristic shape of these species, but the enlarged and truncated posterior part is more evenly rounded, and the posterior end not so much produced. At least one of my females (the largest) has an indication of the "constriction" seen in old specimens of the two other species.

**EURYNIA (MICROMYA) LIENOSA** (Conrad). (See: Ortmann, 1912, p. 340).

In addition to the specimens investigated previously (from Mississippi), I received a gravid and discharging female from H. E. Wheeler, collected May 19, 1911, in the Ouachita River, Arkadelphia, and several gravid females collected in September, 1911, in Big Deceiper Creek, Gum Springs, Clark Co., Arkansas.

The glochidia agree with those described previously, but their general shape should be called subspatulate, with almost straight anterior and posterior margins. Length, 0.20; Height, 0.27 mm.

**EURYNIA (EURYNIA) SUBROSTRATA** (Say). (See: *Lumpsilis* s. Simpson, 1900, p. 546).

Specimens from Big Deceiper Creek, Gum Springs, Clark Co., Ark., collected by H. E. Wheeler, September, 1911. Two were gravid females, one with eggs, the other with glochidia.

Mantle connection between anal and supraanal long, over twice as long as the short anal, and somewhat longer than the supraanal. Inner edge of anal crenulated, that of branchial with papillae. In the female, the inner edge of the mantle, in front of the branchial, carries a row of numerous, small, but distinct papillae, which are subcylindrical or subconical, of rather uniform size (the largest in the posterior part), and are somewhat distant from each other. A black streak extends from the branchial to a certain distance forward. In the male, the black streak is short, and the papillae are rudimentary and very distant from each other.

Palpi with one-third of the posterior margins connected. Inner lamina of inner gills entirely connected with abdominal sac, but sometimes a small hole is present at the posterior end of the foot.

Marsupium in the posterior half of the outer gills, in my specimens, with 18 to 25 ovisacs. Edge with some blackish-brown pigment.

Glochidia subovate (not subspatulate), higher than long. Length, 0.21; height, 0.26 mm. They are closely allied to those of *E. nasuta*, but are distinctly smaller ( $0.25 \times 0.29$  mm. in *nasuta*).

The glochidia have been figured by Lefevre and Curtis (Bull. Bur. Fish., 30 [1910], 1912, pl. 8 f. 13, 14, 15), and the fig. 13 gives the shape correctly, but measurements have not been published. Lefevre and Curtis (Journ. Exper. Zool., 9, 1910, p. 95), point to the glochidia of this species as having a shape, which might be regarded as transitional toward the "axe-head" (or "celt") glochidia of *Proptera*. This is quite right; but the glochidia found in the subgenus *Micromya* of *Eurynia* are yet closer to the axe-head type.

The same authors have published (1910, pl. 1, f. 2; 1912, pl. 6, f. 2), a general figure of the soft parts of the gravid female.

In shell characters, this species is near *E. nasuta* (Say), but the papillae of the mantle edge are somewhat larger, and not as closely set. This makes it, to a degree, transitional between typical *Eurynia* and the subgenus *Micromya*. With regard to the glochidia, *E. subrostrata* is more closely allied to *E. nasuta*. Also *E. recta* (Lamarck) has subovate, and not subspatulate glochidia.

LAMPSILIS VENTRICOSA SATUR (Lea). (See: Simpson, 1900, p. 527).

A number of specimens from the Old River of the Ouachita River, Arkadelphia, Clark Co., Ark., collected by H. E. Wheeler, on May 19 and June 26, 1911, among them gravid females with glochidia, discharging on the latter date.

Soft parts entirely like those of *L. ventricosa* (Barnes).

Glochidia like those of *L. ventricosa* in shape, subovate, but distinctly smaller. Length, 0.22: height, 0.25 mm. ( $0.25 \times 0.29$  in *ventricosa*).

This form, according to Simpson, is "a rather delicate, dark colored variety of *ventricosus*." There is nothing "delicate" about my specimens. The form *satur* was founded upon a female, and the male has never been figured. I have males. Both sexes differ from *ventricosa* by greater convexity of the valves, more prominent umbones, and by dark color. The peculiar emargination of the posterior margin of the female is an individual character, restricted to old specimens. Some of my younger specimens are lighter in color, dark olive-green, and have rays. A very similar form is *L. excavata* (Lea)

(Mississippi to Georgia), but this has a rather sharp posterior ridge. Eastern *excavata* are also much lighter in color, but I have specimens from Jackson, Miss., which are as dark as *satur*.

On account of the glochidia, I have the suspicion, that *satur* might be a good species. Intergrading specimens are not known.

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#### NOTES.

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Recently the Boston Society of Natural History received from Prof. Edward S. Morse a pamphlet with the following title on its cover—"PUBLICATIONS OF THE O. G. B. III. MOLLUSCA OF CINCINNATI. CINCINNATI: L. A. BURDSAL, PRINTER. 1876." Wishing to know the origin of this publication, our Librarian wrote to the Cincinnati Society of Natural History and the following information was received from Mr. Lester D. Collier, through the kindness of Mr. Charles Dury. "The pamphlet described was published by some Woodward High School boys and the Burdsal mentioned was one of them. The letters O. G. B. stands for "Our Geological Boys". Wm. Doherty was one. I was well acquainted with these boys, who were much interested in geology. The list of shells was made by them from specimens collected here and mostly by them. Some of them are dead and most (if not all) of them, gone from here. This is my recollection of it". The paper contains twelve pages, including the title page, "List of the mollusca existing in the neighborhood of Cincinnati, Ohio". The preface is dated August 6, 1876. The list contains 103 species.—C. W. JOHNSON.

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SHELLS OF MT. MONADNOCK, N. H.—Mt. Monadnock, where I am staying (for the last seven summers) being mostly spruce-clad and often very dry during the late summer, is a very poor collecting ground for snails. However the excessively wet last July has started them out and by the energetic collecting of Miss Rebecca Kite and myself we have succeeded in getting representatives of the following species from between 2,000 and 3,000 feet altitude, all rare.

*Polygyra albolabris* Say.

- Polygyra palliata* Say. (2 specimens).  
*Polygyra thyroides* Say. (1 dead and broken shell).  
*Pyramidula alternata* Say. (2 specimens).  
*Pyramidula cronkhitei catskillensis* Pils.  
*Strobilops virgo* Pils. (1 specimen).  
*Succinea obliqua* Say. (2 specimens).  
*Zonitoides arboreus* Say. (The least rare species).  
*Vitrea radiatula* Alder. (1 specimen).  
*Agriolimax agrestis* L.  
*Philomycus pennsylvanicus* Pils.  
*Limax* sp. indet. (1 specimen).

—WM. H. DALL.

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#### PUBLICATIONS RECEIVED.

MESOZOIC AND CENOZOIC MACTRINAE OF THE PACIFIC COAST OF NORTH AMERICA. By Earl L. Packard (Univ. of California Publ., Bull. Dept. of Geology, Vol. 9, No. 15, pp. 261–360, pls. 12–35, May, 1916).

This thorough and interesting account of the fossil Mactrinae of that region has also considerable bearing on the recent forms. *Spisula voyi* Gabb, described as a *Callista* (1869) is found to be the same as *S. alaskana* Dall 1894. Eight new species and one new variety are described. The illustrations are excellent.

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NEW MIOCENE FOSSILS. By Axel Olsson (Bull. Amer. Paleontology, Vol. 5, No. 27, 32 pp., 3 pls., July, 1916).

In this paper are described and figured 34 new species and 3 new varieties of mollusca from the Yorktown, Duplin and Choptank formations of Virginia, North Carolina and Maryland, and one species from Alum Bluff, Fla., also a new subgenus *Heterocerithiopsis*.

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A PRELIMINARY CATALOG OF THE NORTH AMERICAN SPHÆRIIDÆ. By Victor Sterki, M. D. (Annals of the Carnegie Museum, X, 1916).

The last general work on our species of this family was that of Prime published in 1865. The growth of collections of freshwater shells since that time has been enormous, and large



areas entirely or quite imperfectly unrepresented in the older collections have been explored. More intensive work and better methods of collecting have resulted also in a great increase of species known from the older States. Most of the material collected in recent years has been studied by Dr. Sterki, who has now given us a systematic catalogue, with distribution, synonymy and descriptions of new forms. The recent species admitted by Sterki and by Prime number as follows:

		<i>Sphaerium</i>	<i>Musculium</i>	<i>Eupera</i>	<i>Pisidium</i>
Sterki	{ Species . . .	31	23	2	88
	{ Subspecies . .	8	9	0	49
Prime.	Species . . .	17	13	1	17

While there has been great increase in all the genera, during the past 50 years, *Pisidium* has been enlarged far more than the genera of *Sphaeria*, in which specific characters are more obvious. To conchologists *Pisidium* is much what *Crataegus* is to the botanists.

A classification into subgenera is given on pages 472-4. The subgenera *Lacustrina* (type *Pisidium idahoense*) and *Fontinalina* (type *P. fontinale*) are new. We may inquire whether authors who give preference to the principle of tautonymy in type selection (International Rules, Art. 30, I, *d*) would consider *Cyclas cornea* the type of *Corneocyclas* Fér., which in that case would replace the subgenus *Corneola* Clessin. Dr. Sterki has a monograph of the American Sphaeriidae under way. Until this is published, conchologists will find the present catalogue indispensable.—H. A. P.

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SOME DIRECTIONS AND SUGGESTIONS FOR COLLECTING THE SPHAERIIDÆ AND AQUATIC GASTROPODS. By Victor Sterki, M. D. This paper, following the preceding, will be found useful by all conchologists collecting freshwater shells, as it gives the methods which have proved most effective.

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A TRIP TO ISLANDS IN LAKE ERIE. By Calvin Goodrich (Annals Carnegie Mus. X, 1916, pp. 527-531).

The record of a collecting excursion made by Dr. Clapp, Dr. Bryant Walker, Mr. Lucas Beecher and the author in July, 1915,

to the group of islands belonging to Ohio and Ontario, of which only two, Put-in-Bay and Green (formerly Strontian) have appeared in previous conchological literature. Lists of the land shells of seven islands are given with a résumé of the geological history of the islands during successive stages of glacial time. The exceptional interest of these faunas as indices of the rate of evolutionary change, giving definite data on the question of the age of well-marked insular races, is alluded to. The paper forms an introduction to the following one.

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NOTES ON THE LAND-SHELLS OF THE ISLANDS AT THE WESTERN END OF LAKE ERIE AND DESCRIPTIONS OF NEW VARIETIES. By George H. Clapp, (Annals Carnegie Mus. X, 1916). The new forms are as follows:

*Pyramidula solitaria strontiana*, Green Island.

*Pyramidula solitaria roseoapicata*, North Harbor Island.

*Pyramidula solitaria mynesites*, Mouse Island.

*Pyramidula alternata eriensis*, Middle Sister and other Islands.

*Polygyra profunda strontiana*, Green, North Harbor, Middle Sister Island.

*Polygyra albolabris goodrichi*, Middle Sister Island.

“Many of the larger shells of these islands show distinct insular modification. . . . Others are indistinguishable from the mainland forms, and this is particularly true of the shells of Put-in-Bay island, where there seems to have been no change in the species we found.” The divergence from mainland forms of the species is notably different on different islands, as in the cases of *Pyramidula solitaria strontiana*, and *roseoapicata*. Different species are diversely modified, so that the differentiation of the races does not appear directly related to the insular conditions, though such relations might become obvious on further investigation. It may be a case of isolation products, due to different mutations occurring in the several colonies. Important facts for evolution might follow further study of the physical, faunal and floral conditions of the islands. At all events, the little exploration by Messrs. Clapp, Goodrich and Walker has opened up an interesting field for research.

A form similar to *P. alternata eriensis* is found in some of the islands off the New England coast. An excellent plate of shell-figures and diagrams showing variation curves illustrate the paper.

H. A. P. & C. W. J.

# THE NAUTILUS.

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## A NEW SUBEMARGINULA FROM CALIFORNIA.\*

BY WILLIAM HEALEY DALL.

Among some specimens sent for examination from California I find a new *Subemarginula* collected by Mrs. W. H. Golisch of Los Angeles at San Nicolas island of the Santa Barbara group.

*SUBEMARGINULA GOLISCHÆ* n. sp.

Shell of moderate size, radiately ribbed, concentrically zoned and radiately striped with dark rose color, the worn apex greenish, the interior whitish, the extreme edge of the slightly crenulated interior margin with the external coloration showing through. Sculpture of rather strong radial ribs, corrugated more or less by strong incremental rugosities, alternated in front and behind with a single feebler rib, on the sides there are two or three minor riblets between the major ribs; apex rather acute, somewhat anterior; marginal notch shallow, its groove distinct on the internal face of the shell; the number of major ribs in the type specimen is about twenty. Length 20; apex behind the notch 7; width 13; height 7.5 mm.

In a general way this shell looks like one of the varieties of *Fissurella volcano* Reeve, except for the entire apex.

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## OBSERVATIONS ON UNIO GIGANTEUS BARNES.

BY L. S. FRIERSON.

Although the common and striking plicated shells were among the first of the Western Unios to receive names, their nomenclature is still considerably confused.

The first species to be named was the *plicatus*. Although that Thomas Say described it in Nicholson's Encyclopedia, was an easily ascertainable fact, Dr. Lea persisted throughout his life in denying this, and he credited the species to LeSueur; an error in which he has been largely followed.

Say's type came from Lake Erie, and it has been claimed therefore that his species is really the flattened form widely known as *undulatus*. But in 1830 Mr. Say wrote the "*plicatus* is a species with very prominent umboes." Therefore the *plicatus* (s. s.) is that form which, as Barnes wrote, "can stand on end." The more common form of the same species which has flattened umboes, is very generally called *undulatus* Barnes. This is an error of nomenclature for two distinct reasons. The earliest name for this form is *costata* Rafinesque. The description of *costata* has been said to be inadequate, but without good reason, for Rafinesque's figure is unquestionably that of a plicate shell. His statement that its "disc is flattened" precludes the *plicata*, (s. s.) and the statement that the "animal is yellow" excludes the *multiplicatus*.

The two forms above named constitute a single species, connected by myriad links. The third form is readily distinguished by its umboes being covered with literations. It is widely but erroneously called *heros* Say, or *multiplicatus* Lea, neither of which names should be used, since either of them have been preceded by at least two (if not three!) names. The earliest name is almost certainly *peruviana* Lamarck. But because of ambiguity this name cannot be used.<sup>1</sup> Another name is the *undulatus* Barnes, almost universally applied to the *costata*, but is without doubt the *heros* Say! Barnes' statement among others, that its "disc is tuberculate below the beaks" almost alone proves this contention. As in the case of *peruviana*, the identity of *undulatus* has been thoroughly confused by authors, about half identifying it with *heros*, the others with *costata*.

Luckily there can be no doubt concerning the identity of the

<sup>1</sup> Lea stated that Lamarck's *Unio peruviana* was what has commonly been known as *U. plicatus*. This identification is entirely borne out by the figure in *Encyclopedie Methodique*, cited by Lamarck—EDS.

name which we now adopt for this magnificent Naiad, *Unio giganteus* Barnes 1823.

This very appropriate name has been totally overlooked by systematists. Simpson, it is true, mentions it; but he credited it to Lea, saying, "*Dr. Lea does not describe this but only states that it is in Dr. Mitchell's collection. Probably it has never been described.*" (Synopsis, 1900, page 767, note 4.)

*Unio giganteus* was, however, described as a named variety of his *crassus* which, as is well known, embraced the plicate shells. (His Variety "*K*," is typical Lake Erie *plicata*!)

Following the general description of *crassus*, Barnes writes—"Variety (i) *Unio giganteus*. Mississippi. Dr. Mitchell's collection." The variety (i) deserves particular notice. A single valve sent by Professor Douglass to Dr. Mitchell weighs fifteen ounces. It is in every respect a gigantic shell. The distance between the points of the two lobes of the cardinal tooth is one inch; the length of the lateral tooth, three inches; diameter of the posterior cicatrix, one inch, and its depth, one-fourth of an inch.

This species, of which four specimens were obtained by the N. W. Expedition, might perhaps constitute a separate species under the designation of *Unio giganteus*. It is *three times* the size of the largest *Unio crassus* mentioned by Mr. Say and M. Lamarck.

Three specimens—

Diameter 2.9,	Length 4.8,	Breadth 7.2,	
" 3.0,	" 4.6,	" 7.0,	
" 3.1,	" 4.7,	" 7.1,	are pre-

served in Dr. Mitchell's collection.

Another specimen—

Diameter 2.9, Length 4.9, Breadth 7.0, and weighing fourteen ounces, is preserved in Gov. Cass's collection, Detroit.

Habitat. The Mississippi, near Prairie du Chien. Prof. Douglass.

These specimens labeled "*giganteus*," in Dr. Mitchell's collection, were mentioned by Mr. Lea, who (in Obs., vol I, page 31, footnote) writes—"The *giganteus* of Dr. Mitchell's collec-

tion is also a *peruviana* which occurs in our western waters of a larger size and more ponderous than any species we know of."

The reader will note that Lea identified the *giganteus* as *peruviana*. At this time (1829) he regarded all the plicate shells as being one species. He never mentioned *giganteus* again! Can it be that this omission arose because of his very evident wish to protect his name of *multiplicatus*?

With the possible exception of *peruviana*, the *giganteus* is the earliest name given to the species, as well as the most appropriate. Following Lea, Simpson placed "*giganteus*" (Lea) under *plicatus*. The *giganteus* of Barnes however can be nothing else than *heros*. No other Naiad attains the dimensions given by him.

This species has recently been erected into a separate genus by Utterback, whence its proper name is now *Megalonaïas giganteus* Barnes, 1823.

#### PLEISTOCENE MOLLUSCA FROM CALLAWAY COUNTY, MISSOURI.

BY DARLING K. GREGER, COLUMBIA, MISSOURI.

During the past season, engineers in charge of river improvement being carried on near Mokane, Mo., called my attention to two localities where an abundance of fossil or semi-fossil shells were being unearthed, and upon their invitation to conduct me to the localities, both were examined, and collections made.

The first place visited was an excavation on the east bank of Middle River, a short distance below the point of its entrance into the gorge of the Missouri. At a depth of twenty-six feet below the level of the flood-plain of the Missouri River, in a black, sticky clay the following species were gathered:

<i>Polygyra profunda</i> ,	<i>Succinea ovalis</i> ?,
<i>Polygyra albolabris</i> ,	<i>Gastrodonta ligera</i> ,
<i>Polygyra thyroides</i> ,	<i>Helicina occulta</i> ,
<i>Polygyra elevata</i> ,	<i>Pyramidula solitaria</i> .
<i>Polygyra clausa</i> ,	<i>Pyramidula alternata</i> ,
<i>Polygyra appressa</i> ,	<i>Pyramidula perspectiva</i> ,



<i>Polygyra inflecta</i> ,	<i>Helicodiscus parallelus</i> ,
<i>Polygyra fraterna</i> ,	<i>Campeloma subsolidum</i> ,
<i>Polygyra monodon</i> ,	<i>Pleurocera</i> sp.?,
<i>Polygyra hirsuta</i> ,	<i>Sphaerium transversum</i> .

The second locality examined was an exposure of typical loess in the government quarry a short distance above the town of Mokane on the M. K. & T. R. R. The full section of strata exposed in the quarry face measures approximately seventy feet ; rising abruptly from the flood-plain of the river, the Jefferson City formation (Ordovician) presents a precipitous face of sixty feet followed by a layer of tough, bluish clay, interspersed with worn fragments of limestone ; upon this bed of clay is deposited a layer of loess that varies in thickness but having probably an average of nine feet. The loess is capped with a layer of soil rich in humus and supports a flora typical of the Missouri Bluff region.

While occasional specimens of the species listed were found throughout the entire thickness of the loess, it was only in a thin zone, about sixteen inches from the base, that they were collected in abundance, in fact they are so abundant in this zone as to attract attention from the highway below, by the white line they present at the top of the quarry, being even more pronounced than the Ordovician-Pleistocene contact.

Of the entire series collected from this exposure, all have lost their color markings and uniformly present the usual chalky appearance common to the fossils of the loess.

A few are filled with a heavy iron-stained deposit ; others are filled with the surrounding loess mass and occasionally specimens are unfilled and crumble to dust upon their removal from the matrix.

Careful examination of all fragmentary as well as the better preserved shells in the collection gathered at this place fails to detect a single aquatic species, the fauna being composed wholly of land forms, and their being massed together in a single layer can be readily explained as an accumulation left in a depression after a torrential rain. However, a misinterpretation of conditions, such as presented in this locality, combined with a lack of knowledge of the habits of the forms found, has led a number

of writers to use just such evidence to advocate the theory of a fluviatile origin for the widely distributed beds of loess in the Missouri Valley region.

By passing a quantity of the material from the shell zone over a set of sieves of different mesh, I was enabled to recover a number of very minute species, some of them, notably *Carychium exile* Lea, being quite abundant.

List of species from the government quarry near Mokane, Mo.:

<i>Polygyra albolabris</i> , (a)	<i>Pyramidula solitaria</i> , (c)
<i>Polygyra appressa</i> , (a)	<i>Pyramidula alternata</i> , (a)
<i>Polygyra appressa</i> , small var., (c)	<i>Pyramidula alternata</i> , small var., (c)
<i>Polygyra elevata</i> , (a)	<i>Gastrodonta ligera</i> , (r)
<i>Polygyra multilineata</i> , (r)	<i>Helicodiscus parallelus</i> , (c)
<i>Polygyra thyroides</i> , (c)	<i>Vallonia pulchella</i> , (a)
<i>Polygyra zaleta</i> ?, (c)	<i>Vallonia</i> sp. indet., (r)
<i>Polygyra fraterna</i> , (c)	<i>Bifidaria contracta</i> , (c)
<i>Polygyra monodon</i> , (c)	<i>Bifidaria armifera</i> , (c)
<i>Polygyra hirsuta</i> , (c)	<i>Bifidaria procera</i> ?, (r)
<i>Zonitoides arborea</i> , (r)	<i>Carychium exile</i> , (a)
<i>Zonitoides minuscula</i> , (c)	<i>Helicina occulta</i> , (c)

(a) = abundant, (c) = common, (r) = rare.

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#### THE FEEDING HABITS OF BUSYCON.

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BY SHIELDS WARREN.

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Last September I made a series of observations on the feeding habits of *Busycon* at Hyannisport, Massachusetts. This place was well suited for the work, since both *B. canaliculata* and *B. carica* occur plentifully, and oysters and quahaugs are fairly numerous. All these observations were made under natural conditions.

There are two distinct stages in the feeding habits, the first when the animal is small and the shell weak, the second when the animal is grown and the shell strong. In the first stage they are incapable of attacking a large lamellibranch, and eat carrion and small univalves, such as *Nassa*, which occur abund-

antly on the flats. To get at the Nassa, they envelop the shell in the foot until it is asphyxiated, and then clean out the animal with the radula. In the second stage the quahaug and oyster are the chief articles of food, and, contrary to the general opinion, the radula is not used to bore through the shells, but the edges of the valves are chipped away against the lip of the Busycon's shell.

I was led to take up these investigations by the following facts: in examining radulae of the Busycons I noticed that they were not so worn as in the borers *Polinices* and *Urosalpinx*; the lips of their shells are almost invariably chipped: and the dead quahaug shells on the flats were not bored but chipped.

Subsequently I found that Mr. Harold S. Colton had described (*Proc. Acad. Nat. Sci., Phila*; 1908) the feeding of *B. canaliculata* as observed in the aquarium of the University of Pennsylvania. The following statements are quoted from his summary.

"They (*canaliculata* and *carica*) open the shells of oysters by wedging their own shell between the valves and tear out the flesh with their radula. They probably treat quahaugs in the same way.

"*Sycotypus* will attack any except *Venus*."

He also states that the whelk waits until the bivalve opens and then inserts its shells between the valves.

Mr. C. W. Johnson suggested to me that the bivalves might have been weakened by life in the aquarium, and this is probably the explanation of the shells' opening their valves while gripped in the Busycon's foot. Also while *B. canaliculata* will not attack quahaugs as early in life as *B. carica*, since the lip of its shell remains almost paper-like until the animal is well grown, I found two large specimens eating quahaugs.

The Busycons I observed ate in the following manner. An oyster is held in the foot with the hinge toward the canal, while a quahaug is grasped in such a way that the hinge is toward the columella, but in both cases the edges of the bivalve are left free. In the majority of cases the Busycon rests on its foot with the canal pointing upwards at an angle of about 30°. The foot is slowly contracted, about six times a minute, and the

edge of the oyster is brought against the inner edge of the lip with considerable pressure and then drawn inward and toward the canal. A small piece is chipped from the edge of the oyster and the process repeated until a gap is made large enough to admit the radula, which then tears out the flesh. This method of getting at the animal explains not only the roughened and chipped condition of the lip of the Busycon, but also the chipped oyster and quahaug shells. Occasionally I have found a live quahaug with its edge much chipped but still intact, so the whelk does not always succeed. Usually, however, it encounters but little difficulty.

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DESCRIPTIONS OF NEW SPECIES FROM THE CRETACEOUS AND  
TERTIARY OF THE TESLA, PLEASANTON, SAN JOSE, AND  
MT. HAMILTON QUADRANGLES, CALIFORNIA.

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BY E. B. HALL AND A. W. AMBROSE.

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INTRODUCTION.

During the paleontological work at Stanford University, for a folio covering the Tesla, Pleasanton, San Jose and Mt. Hamilton Quadrangles, several new forms were found. In order that the names of these might be established, the writers decided to publish the descriptions of the same. The writers' thanks are due Dr. James Perrin Smith for his assistance to the writers in this work.

HORSETOWN—MIDDLE CRETACEOUS.

PECTEN CLARKENSIS n. s. Hall and Ambrose.

*Description.* Shell small, two specimens found averaging 17 mm. in altitude, little higher than long, compressed, thin, sub-circular, equivalve and equilateral; ears equal, moderately small, base regularly rounded, margins smooth. Surface marked by 20 or 21 radiating nearly equal ribs, being two or three times the width of interspaces that terminate abruptly a little way from margin, also by obscure lines of growth.

*Dimensions.* Alt., 16 mm.; latitude, 16 mm.; longitude, 18 mm.; hinge line (restored and approximate) 9 mm.; diameter, 11 mm.

*Notes.* Characterized by definite number and character of ribs, and easily distinguished from *P. operculiformis*, *P. californicus*, *P. complexcosta*, and *P. interradiatus*. Named in honor of W. O. Clark.

*Type.* Museum, Stanford University, Calif.

*Locality.* Found by W. O. Clark on the San Jose Quadrangle, two and a half miles Northeast of Milpitos, just at beginning of foothills and a little north of serpentine outcrop.

*Horizon.* Horsetown, middle Cretaceous.

AVICULA GREGORYI, n. s. Hall and Ambrose.

*Description.* Shell oblique, subcompressed; ears very unequal; beaks moderate, anterior; cardinal line straight; anterior ear short and angular with small byssal notch; posterior ear broad; anterior margin regularly rounded from near umbo to base, posterior margin straight and sharply rounded to base, basal margin forms an excentric curve, most produced behind. Ears gradually round into body of shell. Surface marked by numerous faint, but distinct, radiating ribs.

*Dimensions.* Altitude 7 mm.; longitude 9 mm.; hinge line 5 mm.; diameter.

*Notes.* Distinguished from *A. pellucida* by ribs, byssal notch and lack of acuminate posterior ear. Named in honor of A. E. Gregory, Stanford University, Calif.

*Type.* Museum, Stanford University, Calif.

*Locality.* One and one-half miles S. 10 W. of Carnegie, Tesla Quadrangle.

*Horizon.* Horsetown, middle Cretaceous.

SONNERATIA ROGERSI, n. s. Hall and Ambrose.

*Description.* Shell small, not often above a diameter of 4.5 mm.; discoidal, laterally compressed and flattened; umbilicus not large, about one-quarter total diameter, funnel form due to sloping sides and gradual increasing thickness of shell; sides converge gently toward periphery; ventral surface subquadrate; surface ornamented with about sixty transverse flexuous ribs which usually cross the ventral surface and terminate in about one-quarter as many distinct tubercles upon the shoulder of

the umbilicus. The ribs show a tendency to bifurcate from these ridge-like tubercles, and become less distinct on the sides of the shell, curving gently backward, and becoming very distinct and wider near the outer margin where they turn decidedly forward. The suture line is simple, consisting of a few broadly rounded saddles and wide lobes having very short branches. Saddles little indented, and are bifid with rounded denticles and incisions. Lobes unequally tripartite.

*Notes.* This form easily distinguished from *S. stantoni*, as it has nearly twice as many ribs, a lack of fine lines, striations on ribs and interspaces, and a greater size. Named in honor of Professor A. F. Rogers, Stanford University, Calif.

*Type.* Museum, Stanford University, Calif.

*Locality.* Three-quarters of a mile South of Carnegie, Corral Hollow, Tesla Quadrangle.

*Horizon.* Horsetown, middle Cretaceous.

#### CHICO—UPPER CRETACEOUS.

ATAPHRUS PEMBERTONI, n. s. Hall and Ambrose.

*Description.* Shell medium, thick, rather flattened, spire low; whorls four, rounded, enlarging rapidly anteriorly, and revolving a little obliquely; whole body being about twice as large as penultimate. Aperture oblique, subcircular, columellar lip thick and rather straight. Surface smooth, marked only by occasional very faint lines of growth; umbilical region covered by a smooth callus, which merges insensibly into general surface.

*Dimensions.* Alt., 12 mm.; lat., 18 mm.; alt. of body whorl, 7 mm.; alt. of aperture, 9 mm.

*Notes.* Distinguished from *A. crassa* by its size, higher spire, and non-rounding of columellar lip. Named in honor of J. R. Pemberton.

*Type.* Museum, Stanford University, California.

*Locality.* Jordan Ranch, Arroyo del Valle, Tesla Quadrangle, Alameda County, California.

*Horizon.* Lower Chico, upper Cretaceous.

CERITHIUM BRANNERI, n. s. Hall and Ambrose.

*Description.* Shell elongate, slender; whorls numerous, prob-



ably eight, two apical whorls being lost, rounded on sides; suture linear, impressed. Surface marked by numerous, slightly curved longitudinal ribs, about twenty-six to a volution; these are more prominent near upper suture of the whorl and become very indistinct at the lower suture; very fine striae cover both ribs and interspaces, running parallel with ribs; ribs and interspaces crossed alike by numerous shapely elevated revolving threads, running parallel to suture. These produce a small node at each crossing of the longitudinal rib one-quarter of the way down on the lowest whorl, one-third down on the second, one-half down on the third, and the entire way down on the remaining whorls. Aperture, sub-circular; inner margin somewhat thickened and curved.

*Dimensions* (less several apical whorls). Alt., 16 mm.; lat., 7 mm.; alt. of body whorl, 13 mm.; alt. of aperture,  $4\frac{1}{2}$  mm.

*Notes.* Named in honor of Dr. John C. Branner.

*Type.* Museum, Stanford University, California.

*Locality.* One mile north,  $20^{\circ}$  west of Tesla and Corral Hollow, Tesla Quadrangle.

*Horizon.* Middle Chico, upper Cretaceous.

(To be continued)

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#### NOTES.

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FOSSIL CHITONS. In working over some fossil shells from the Pleistocene strata of Deadman's Island, San Pedro, California, I find that I have three species which are not listed by Arnold in his "Paleontology and Stratigraphy of the Pliocene and Pleistocene of San Pedro."

*Katherina tunicata* Sby. One perfect anterior valve.

*Ischnochiton conspicuus* Cpr. One perfect posterior valve.

*Mopalia hindsii* (Sby.) Rve. One central valve in good condition.

These were identified by comparing with recent specimens. *Ischnochiton conspicuus* is found living in this vicinity and has been reported fossil from the Pleistocene at Signal Hill, Long Beach, by Mr. T. S. Oldroyd. (NAUTILUS, vol. 28, page 80.)

*Katherina tunicata* and *Mopalia hindsii* are found living at Monterey and farther north but are not found living in this locality.—E. P. CHACE.

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VIRIPARUS CONTECTOIDES BINN. IN BOSTON, MASS. This species has recently appeared in great numbers in the Lake in the Public Garden. Adults measuring 23 mm. (slightly eroded) are comparatively scarce, but specimens measuring from 9 to 13 mm. are abundant. Mr. E. G. Vanatta has recorded it from the lily pond, Fairmount Park, Philadelphia (NAUT. vol. 26, p. 84, 1912). As this species is frequently kept in aquaria, it has probably been introduced in the Lake with goldfish which are annually placed there.—C. W. JOHNSON.

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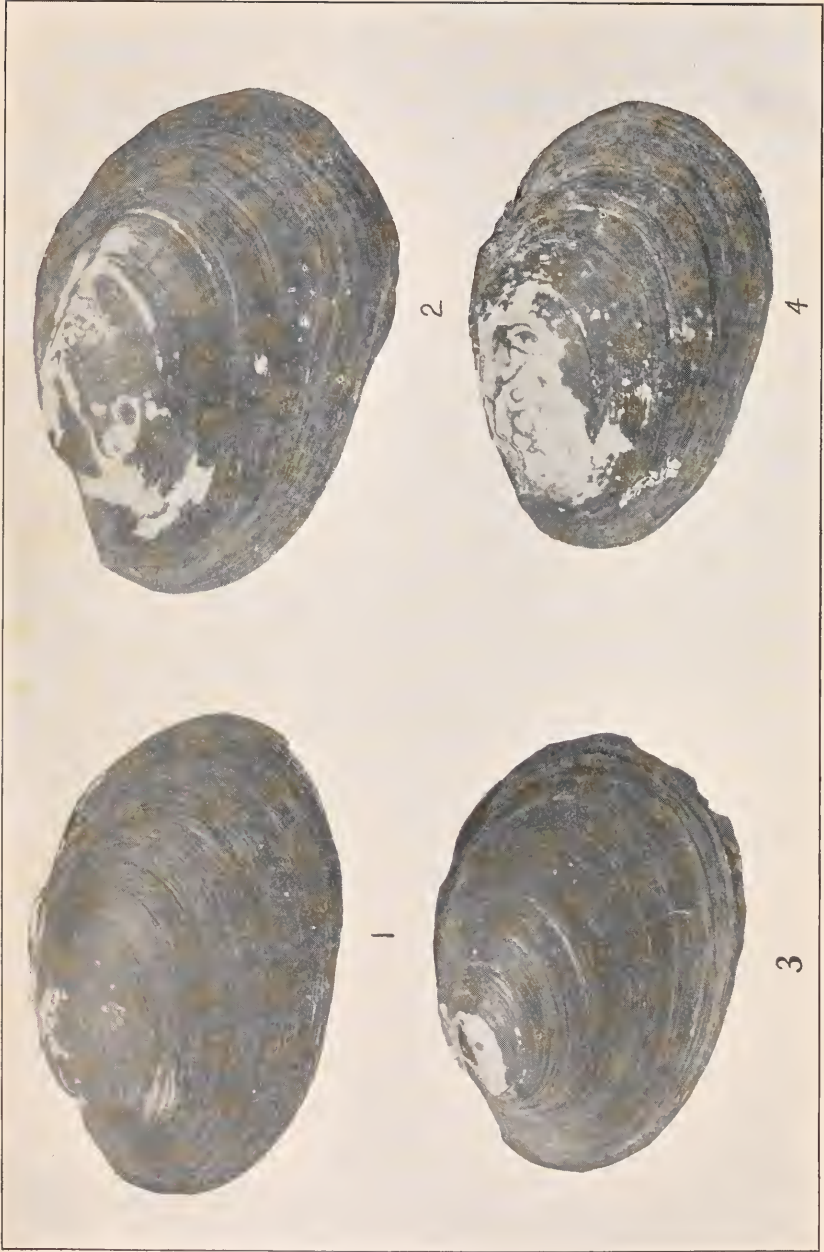
MELANELLA IOTOIDES.—When I published *Melanella iota* in my "Report on the Turton Collection of South African Marine Mollusks," Bulletin 91, U. S. National Museum, page 67, plate 19, fig. 2, 1915, I overlooked the existence of a previously described *Melanella* bearing this name; namely, *Eulina iota* C. B. Adams, Ann. Lyc. Nat. Hist. N. Y., p. 422, 1852.

My shell therefore requires a new name, and may be known as *Melanella iotoides*.—PAUL BARTSCH.

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NEW JERSEY SHELLS.—The following species of shells were picked from leaf-mould collected by Mr. Bayard Long on April 7th and May 19th, 1916, near Garden Lake Station, west of Clementon, Camden county, New Jersey. The *Euconulus* and *Strobilops* are southern species new to the state: *Polygyra albolabris* Say, *P. thyroidus* Say, *P. fallax* Say, *Pupoides marginatus* Say, *Bifidaria armifera* Say, *B. contracta* Say, *B. pentodon* Say, *Vertigo tridentata* Wolf, *V. milium* Gld., *Strobilops floridana* Pils., *Vallonia excentrica* St., *Columella edentula* Drap., *Polita hammonis* Ström., *P. indentata* Say, *Striatura milium* Mrse., *Zonitoides arborea* Say, *Z. minuscula* Binn., *Agriolimax campestris* Binn., shell only, *Euconulus chersinus trochulus* Reinh., *Helicodiscus parallelus* Say, *Punctum pygmæum* Drap., *Succinea avara* Say, and *Carychium exiguum* Say.—E. G. VANATTA.





UNIO RADIATUS ONEIDENSIS BAKER.

# THE NAUTILUS.

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## EULIMASTOMA, A NEW SUBGENUS OF PYRAMIDELLIDS AND REMARKS ON THE GENUS SCALENOSTOMA.

BY PAUL BARTSCH.

Additional material received by the United States National Museum makes it necessary to create a new subgenus for the Pyramidellids typified by *Odostomia* (*Scalenostoma*) *dotella* Dall and Bartsch (Bull. 68, U. S. N. M., p. 230, 1909). *Scalenostoma* must be referred to the family *Melanellidae* (= *Eulimidae*).

There is a wonderful resemblance between *Eulimastoma* and *Scalenostoma* as far as texture of shell and sculpture are concerned, and it was this resemblance and the absence of representatives of the genus *Scalenostoma* that caused me to consider this a Pyramidellid in the past. Material now at hand shows that *Odostomia* (*Eulimastoma*) *dotella* Dall and Bartsch has an obliquely tilted, deeply immersed nucleus, a Pyramidellid character, while *Scalenostoma* has the usual attenuated, acute, non-sinistral tip.

*The following synonymy should be noted :*

*Scalenostoma* Deshayes, Cat. Moll. Ile de la Reunion, pp. 58-60, Pl. vii, figs. 26-8, 1863. Type *Scalenostoma carinatum* Deshayes = *Subeulima* Souverbie, Journ. de Conch. xxiii, p. 296, 1875. Type *Subeulima lamberti* Souverbie.

The west American members of the genus *Scalenostoma* are:

*SCALENOSTOMA RANGII* (de Folin).

*Chemnitzia rangii* de Folin. Les Meleagrinicoles p. 61, Pl. 6, fig. 1, 1867. *Odostomia* (*Scalenostoma*) *rangii*, Dall and Bartsch Bull. 68, U. S. N. M., p. 230, Pl. 30, fig. 2, 1909. *Odostomia*

(*Scalenostoma*) *rangii*, Bartsch, Proc. U. S. N. M., No. 1906, p. 307, 344, 1912.

SCALENOSTOMA BABYLONIA (Bartsch).

*Odostomia* (*Scalenostoma*) *babylonia* Bartsch, Proc. U. S. N. M., No. 1903, pp. 287-8, Pl. 38, fig. 3, 1912, *Odostomia* (*Scalenostoma*) *babylonia* Bartsch, Proc., U. S. N. M., No. 1906, p. 307, 344, 1912.

The South African species of this genus which I described in the Report on the Turton Collection of South African Marine Mollusks, Bull. 91, U. S. N. M., p. 70, Pl. 19, fig. 6, 1915, as *Subeulima magnifica* must now be called *Scalenostoma magnifica* (Bartsch).

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DESCRIPTION OF A NEW VARIETY OF LAMPSILIS FROM ONEIDA LAKE  
WITH NOTES ON THE L. LUTEOLA GROUP.

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BY FRANK C. BAKER.

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LAMPSILIS RADIATA ONEIDENSIS F. C. BAKER. Plate II.

Shell elliptical in outline, rounded at both ends, somewhat compressed; dorsal margin slightly curved, ventral margin rounded, notably so in the male shell; female shell produced postbasally; surface usually roughened by growth lines, rarely smooth; epidermis olive-green, the posterior half usually black or brown, obscuring the markings; a few dark green rays of the *radiata* type are present on some shells; umbones prominent, inflated, but little elevated above the contour of the dorsal margin; unbonal slopes rounded; cardinal teeth of the left valve double, rather heavy, serrated, the anterior cardinal higher than the posterior and pyramidal in shape, the posterior cardinal rectangular somewhat compressed; the pit between the cardinal teeth is deep and wide; there is a small, narrow pit at the base of the anterior cardinal tooth; cardinal teeth of right valve two in number, triangular, the anterior small, compressed, the posterior large, elevated above the anterior, forming a truncated pyramid; the pit between the teeth is narrow and deep; the anterior cardinal of this valve is reduced to a mere remnant in some individuals; the ridge joining the cardinal and lateral



teeth is heavy and bears one or more tubercles ; lateral teeth as in *radiata* ; anterior adductor muscle scar, posterior adductor muscle scar, and dorsal muscle scars more heavily impressed than in *radiata* ; nacre bluish-white, slightly iridescent.

All of the specimens seen have their umbones eroded.

Length 56, height 36, breadth 21 mm. ♂.

“ 53, “ 35, “ 20 mm. ♀.

“ 51, “ 37, “ 20 mm. ♂.

“ 60, “ 40, “ 24 mm. ♀.

“ 66, “ 41, “ 27 mm. ♂.

“ 63, “ 41, “ 27 mm. ♀.

Types in collection of the New York State College of Forestry at Syracuse University ; cotypes in collection of the Academy of Natural Sciences of Philadelphia and Dr. Bryant Walker, Detroit, Mich.

This race of *Lampsilis* is related to both *radiata* and *luteola*. From the latter it differs in the more elliptical sometimes orbicular outline of the male shell, the olive green and brown epidermis and in the cardinal teeth which are heavier and broader, not so deeply serrated, and of different shape. From *radiata* it differs in its outline, in its epidermis, which is not as rough, and in the cardinal teeth, which are not as heavy, and are more elevated, triangular and pyramidal. The pits at the base of the cardinal teeth are deeper.

This race is common in Oneida Lake and is very uniform in the characteristics noted. It was previously listed<sup>1</sup> as *Lampsilis borealis* but specimens of *borealis*<sup>2</sup> from the type locality, Duck Island, Ottawa River, Ontario, Canada, received from Dr. Walker, show that it is not that species, true *borealis* having a heavier, more inflated shell, heavier and differently shaped cardinal teeth and an epidermis like that of *radiata*. Small females of *oneidensis* have a superficial resemblance to *Lampsilis*

<sup>1</sup> The Fresh-water Mollusca of Oneida Lake, New York. NAUTILUS, xxx, page 7, 1916 ; The Relation of Mollusks to Fish in Oneida Lake. Tech. Bull. No. 4, New York State College of Forestry at Syracuse University, page 257, fig. 44, 1916. The references to *borealis* in the latter publication should be changed to *oneidensis*.

<sup>2</sup> Trans. Ottawa Field Nat. Club, No. 3, page 53, 1882.

*luteola rosacea* but differ in the form of the cardinal teeth as well as in the outline of the shell and in the color and texture of the epidermis.

*Oneidensis* apparently bears the same relation to *radiata* that *rosacea* does to *luteola*. It is not a depauperate or sporadic form of *radiata*, for it occurs plentifully and is always recognizable at a glance when mixed with *luteola* and *radiata*. A lot of shells from Lower South Bay contained these three mussels in the ratios indicated: *oneidensis*, 28; *radiata*, 15; *luteola*, 16. Individuals occur with a pink shell and nacre like that of the race *rosacea*. How widely distributed this race of *radiata* may be is not known but it should be found in other parts of New York State.

The *luteola* group of *Lampsilis* living in Oneida Lake is of unusual interest from the standpoint of variation. Here the two species have apparently interbred, causing a mixture of the characters of both species. Thus, individuals of *radiata* occur with a normal hinge but with a polished surface like *luteola*. Also, *luteola* individuals occur with a rough surface and the crowded rays of *radiata*. The breadth of shell in both species varies nearly fifty per cent. All specimens of *luteola* are more numerously rayed than are those from the West and also those from Western New York, showing apparently a tendency to vary toward the *radiata* type of surface. A tinge of red is found in individuals of all species, though not as strikingly as in the typical *rosacea* of DeKay.

A form of *luteola* occurs in the lake which is much compressed (resembling in this respect *radiata*) the epidermis is smooth and the bright green rays are widely spaced. These individuals are noteworthy for the marked elliptical outline of the shell and the acute V-shape formed by the ventral half of the shell. Measurements are given below of these specimens together with typical forms of *radiata* and *luteola*. All are males.

Length 80, width 47, breadth 27 mm.	<i>Luteola</i> , compressed.		
“ 58, “ 34, “ 19 mm.	<i>Luteola</i> , compressed.		
“ 64, “ 40, “ 35.5 mm.	<i>Luteola</i> , typical.		
“ 62, “ 38, “ 35.5 mm.	<i>Radiata</i> .		
“ 80, “ 25, “ 25 mm.	<i>Radiata</i> , Mohawk river.		

The *radiata* of Oneida Lake are not typical being more inflated, quadrate in outline rather than elliptical, the rays are not as even or as numerous and the color of the shell is usually yellowish rather than greenish, in this respect approaching *luteola*. The *radiata* type in the lake shows a decided variance toward the form of the shell herein described as *oneidensis*.

The only safe criterion for separating the Oneida Lake *radiata* from *luteola* is by the form of the cardinal teeth. Many years ago F. R. Latchford<sup>1</sup> tersely characterized these differences as follows: "In *U. radiatus* these are short, erect, and triangular. In *U. luteolus* they are long, curved, compressed, and oblique." The dull, rough epidermis is characteristic of *radiata* but, as noted in Oneida Lake specimens this may not be present or typically developed. It seems evident that in Oneida Lake evolutionary forces have been at work upon this group of the Naiades and that the form herein described as *oneidensis* is the result.

Figures 1 and 3 represent male, 2 and 4 female individuals.

My thanks are due Dr. Bryant Walker for assistance in working out the relationships of this race and also Dr. C. C. Adams, of the New York State College of Forestry, for the loan of the plate upon which the race is figured.

New York State College of Forestry,  
Syracuse University.

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DESCRIPTIONS OF NEW SPECIES FROM THE CRETACEOUS AND  
TERTIARY OF THE TESLA, PLEASANTON, SAN JOSE, AND  
MT. HAMILTON QUADRANGLES, CALIFORNIA.

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BY E. B. HALL AND A. W. AMBROSE.

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(Concluded from page 71)

PHOLADOMYA HARRIGANI, n. s. Hall and Ambrose.

*Description.* Shell, right angle, thick; beaks low, anterior, in-curved, nearly touching. Buccal end abruptly truncated at

<sup>1</sup> Notes on the Ottawa Unionidae. Trans. Ottawa Field Nat. Club, No. 3, page 51, 1882.

right angles to cardinal and basal margins. Cardinal margin regularly rounded anteriorly from beaks; anterior end rounded into straight basal margin; posterior end, anterior end and basal margin closed. Surface marked by prominent irregular lines of growth following curvature of shell and extending continuously along sides and on posterior end to umbones, also marked by 17 to 19 less prominent radiating, regularly spaced ribs that cover entire surface of sides and do not extend on to posterior end as in the case of the lines of growth. The radiating ribs become more prominent proceeding from the anterior to the posterior end.

*Dimensions.* Length, 50 mm. Posterior width, 40 mm. Posterior thickness, 35 mm. Greatest width and thickness at posterior end.

*Notes.* Named in honor of P. F. Harrigan, Los Angeles, Calif.

*Type.* Museum, Stanford University, Calif.

*Locality.* Black shale, Western Pacific Railroad cut near Altamont, Tesla Quadrangle.

*Horizon.* Upper Chico, upper Cretaceous.

SCHLOENBACHIA TEMPLETONI, n. s. Hall and Ambrose.

*Description.* Shell discoidal and compressed, slightly inflated on the last whorl, attains a diameter of 16 cm. Keel slight and broken into nodes. Surface ornamented with about 45 (counted along ventral margin) rounded, slightly curved, forward pointing ribs, that begin in narrow elongated nodes (slightly diverging from plane of keel) on the ventral margin and end on the umbilical margin in about a third as many pointed nodes as ribs, from which the umbilical walls make a perpendicular descent. Some of the ribs bifurcate on the surface of the shell in nodes without any apparent regularity of system and from three series of costal nodes on the surface—not counting the umbilical and ventral margin nodes—and run nearly regularly with the curvature of the whorl. The nodes on the ventral margin are opposite each other. The tubercles of the keel stand a little forward of the marginal nodes in a position to exactly meet the forward curving of the ribs.

*Notes.* Named in honor of E. C. Templeton, Stanford University, California.

*Type.* Museum, Stanford University, California.

*Locality.* Western Pacific Railroad cut between Altamont and Greenway, Tesla Quadrangle.

*Horizon.* Upper Chico shale, upper Cretaceous.

#### TEJON—UPPER EOCENE.

PANOPEA SMITHII, n. s. Hall and Ambrose.

*Description.* Shell subquadrate, about twice as long as wide; beaks small, nearly central but a little toward the posterior end. Cardinal margin nearly straight anteriorly with end regularly rounded, slightly sloping posteriorly with end abruptly truncated, basal margin slightly concave. Posterior end gaping, anterior end and basal margin closed. An angulated furrow runs from the umbones to posterior end of basal margin. A gently curved furrow runs from umbones to center of basal margin, giving a bulging appearance to both dorsal and ventral ends. Surface marked by coarse, rather regular ribs.

*Dimensions.* Length, 72 mm.; width, 37 mm., apparently from others found, this form represents the adult form.

*Notes.* Named in honor of Professor James Perrin Smith, to whom the authors are deeply indebted.

*Type.* Museum, Stanford University, California.

*Locality.* Creek cut opposite where Livermore road crosses the Western Pacific Railroad, Corral Hollow, Tesla Quadrangle.

*Horizon.* Tejon, Upper Eocene.

#### MONTEREY—LOWER MIOCENE.

MESODESMA PACIFICA, n. s. Hall and Ambrose.

*Description.* Right valve. Cast. Shell subtrigonal, inequilateral. Beak small. Posterior end truncate, at extremity making angle of  $133^{\circ}$  at beak between posterior dorsal margin and anterior dorsal margin, anterior margin straight, abruptly truncated at end, deep furrow cutting at angle of  $25^{\circ}$  to anterior dorsal margin from beak, gradually disappearing until obscure at center of valve.

*Dimensions.* Long. 40 mm.; alt. 22 mm.; diameter 4 mm.

*Notes.* This form is easily recognized by its shape and posterior truncation. Harold Hannibal has collected this form on Vancouver Island in the Sooke Formation (Oligocene). The writers had the opportunity of comparing the material with a specimen collected by Mr. Hannibal. It showed a strong hinge, a large resiliary pit, rather deep, and a thick shell, with concentric striation.

*Type.* Museum, Stanford University, Calif.

*Localities.* Monterey Sandstone, P. 282, on the Pleasanton Quadrangle, in Alameda Creek,  $1\frac{1}{2}$  miles south of Mouth of Welch Creek, and one-fifth mile south of Calaveras Fault, Sunol, Calif.

*Horizon.* Monterey Sandstone, Lower Miocene.

MACTRA BEALI, n. s. Hall and Ambrose.

*Description.* Left valve. Shell trigonal, thin, slightly ventricose, inequilateral; umboes prominent; beaks not prominent, situated slightly posterior to middle of shell; anterior margin slightly curved upward, running to anterior extremity where it is sharply rounded; posterior margin practically straight, running to posterior extremity where it is angularly truncated; basal margin regularly curved; posterior and anterior margin make an angle of  $105^\circ$  at the beak; surface smooth.

*Dimensions.* Long. 44 mm.; lat. 34 mm.; diameter 9 mm.

*Notes.* It is very similar to an unnamed form found by Harold Hannibal in the Sooke formation (Oligocene) of the North Pacific coast. Named in honor of C. H. Beal, Stanford University, Calif.

*Type.* Museum, Stanford University, Calif.

*Locality.* Monterey Sandstones of Pleasanton Quadrangle. This particular valve came from locality P. 227.

*Horizon.* Monterey Sandstone, Lower Miocene.

#### BRIONES—MIDDLE MIOCENE.

OSTREA TITAN Conrad. VAR. PERRINI, n. var. Hall and Ambrose.

*Description.* Lower valve. Shell irregularly elliptical, contracted at beak; beak curved toward right when viewed from



exterior ; right valve very ventricose ; extremely laminated, giving rough plaited surface ; left valve almost flat, laminated ; muscle-scars distinct ; hinge long, narrowing at beak, viewed from interior curves to left ; cavity of hinge deep, coarsely wrinkled, with wrinkles running up onto either side of hinge ; interior of hinge ends abruptly, cutting at right angles toward interior of shell, although not characteristic of all forms.

*Dimensions.* Alt. 155 mm. ; long. maximum at base, 85 mm., minimum near beak 56 mm. ; diameter lower valve 61 mm.

*Notes.* This species greatly resembles *O. titan* Conrad, the main difference between the two being in the hinge. This variety has a long curved pointed hinge, while the *O. titan* has a much shorter hinge, about as wide as long. Also the summit of this variety does not rise above the beak of the opposite valve. All forms do not have as curved a hinge as this one figured. It is generally elongate, and seldom, if ever, has the subcircular shape the *O. titan* often has.

It is very abundant in the Briones, and may generally be found any place in the Briones on the Tesla, Pleasanton, Mt. Hamilton or San Jose Quadrangles. This particular specimen is slightly smaller than the ordinary *O. titan* var. *perrini*.

It is named in honor of Professor James Perrin Smith.

*Type.* Museum, Stanford University, Calif.

*Locality.* Briones of the Tesla, Pleasanton, San Jose and Mt. Hamilton Quadrangles, Calif.

*Horizon.* Briones, Middle Miocene.

MACOMA WILCOXI. Hall and Ambrose.

*Description.* Right valve ; shell thin, elongate, inequilateral ; surface smooth ; beaks, small, low, pointed, nearly medial, curved slightly toward posterior end ; anterior extremely regularly rounded ; posterior dorsal margin straight, sloping more steeply from beak than anterior dorsal margin toward extremity which is angulated at a point somewhat below the horizontal medial line of the valve ; base curved. Hinge unknown, interior inaccessible.

*Dimensions.* Long., 31 mm. ; lat., 18 mm. ; diameter, 5 mm.

*Notes.* The angular posterior extremity gives it a distinctive shape. It is named in honor of R. W. Wilcox, Delta, Colorado.

*Type.* Museum, Stanford University, California.

*Locality.* This specimen was found in Briones reef sandstones on the north limb of the Haywards Pass syncline. It is also found on the anticline northwest of Dublin, California. It is also found on the Tesla Quadrangle in the clays at the mouth of the small gulch joining Arroyo Seco from south, one-half mile above 963 Mark, Livermore, California.

*Horizon.* Briones, Middle Miocene.

PECTEN TOLMANI, n. s. Hall and Ambrose.

*Description.* Both valves convex, left more convex of two, inequilateral, base regularly rounded; margins smooth. Right valve with 16 to 18 prominent rounded ribs, separated by rounded interspaces, narrower than the ribs; ribs on left valve more prominent and irregularly spaced; surface sculptured by numerous, fine, imbricating, regular lines of growth; hinge line less than one-half length of disk; ears subequal; anterior ear of other specimens show 5 or 6 sharp radial lines emanating from beak, crossed by fine, faint, concentric lines; sculpture of posterior ear less distinct but truncated at right angles.

*Dimensions.* Alt. 67 mm.; long. 71 mm.; diameter 9 mm.; umbonal angle 130°.

*Notes.* This species resembles an enlarged *P. andersoni* but is undoubtedly a new form. This form is much larger than *P. andersoni*, the hinge (proportional to size) much shorter, and the umbonal angle much larger.

It is possible this form is a descendant of *P. andersoni*, of Monterey times. The young are very similar to *P. andersoni*, and it is not certain that the forms classified as *P. andersoni* in the Briones are not the young of *P. tolmani*. Named in honor of Prof. Cyrus Fisher Tolman, Jr.

*Type.* Museum, Stanford University, Calif.

*Locality.* Briones of Tesla, Pleasanton, San Jose and Mt. Hamilton Quadrangles.

*Horizon.* Brionet, Middle Miocene; probably Monterey, Lower Miocene.

## NOTES.

SAN DIEGO DRIFT SHELLS.—A small bag of drift taken on the shore of False Bay, near Asher Station, San Diego, California, March 28, 1916, contained the following interesting assemblage of molluscan shells, Mr. E. G. Vanatta being responsible for certain of the determinations.

*Pisidium* species.

*Assiminea californica* Cooper, one specimen (E. G. V.).

*Lymnaea bulimoides* Lea, young.

*Physa nuttalli* Lea, young (E. G. V.).

*Planorbis deflectus* Say, two young specimens (E. G. V.).

This species seem to be new to Southern California.

*Succinea stretchiana* Bland, young (E. G. V.).

*Vitrea shepardi* (Hemphill), one specimen (E. G. V.). Recorded heretofore from Santa Catalina Island.

*Striatura milium pugetensis* (Dall).

*Striatura milium meridionalis* (Pilsbry and Ferriss), one specimen (E. G. V.).

*Punctum conspectum* (Bland), the most common species.

*Vertigo diegensis* Sterki, one specimen.

*Bifidaria hemphilli* Sterki.

— S. S. BERRY.

ANTIQUITY OF THE HELICES.—*Helix* (*Epiphragmophora*) *tudiculata* is a land snail peculiar to Central and Southern California, ranging from the Sierras southward to San Diego. It is very common, and even abundant in some localities.

A few years ago the writer found a fossil specimen of this species in Silverado Canyon, Santa Ana Mountains, Orange County, California, which cannot be assigned to a later period than the Miocene, and may be even older, as the Eocene and Cretaceous are also known to occur in Silverado Canyon.

The shell was found *in situ*, being embedded in a ledge of rather soft limestone, which contained numerous fossil leaves and stems. It was remarkably well preserved, retaining much of its original color, and the dark band encircling the larger whorl was still very distinct.

The writer is not aware that the species *tudiculata* has ever before been reported as being identified with any geologic period.—E. E. HADLEY.

NOTE ON VALVATA MICRA Pils. and Ferr.—When this species was described<sup>1</sup> I doubted its pertinence to *Valvata*, suggesting that it might be a *Horatia* or *Daudebardiella*. I have recently seen an article by C. Pollonera,<sup>2</sup> in which he described a sub-

<sup>1</sup> Proc. A. N. S. Phila. 1906, p. 172. New Braunfels, Texas.

<sup>2</sup> Bolletino dei Musei de Zoologia ed Anatomia Comparata della R. Univ. di Torino, Vol. xiii, No. 334, p. 3, Dec., 1898.

genus *Hauffenia* of the genus *Horatia*, with two new species from the valley of the Natisone, in Italy. These shells are very small, diam.  $1\frac{1}{2}$  to 2 mm., and almost exactly the shape of *V. micra* and its variety *nugax* which measure 1.2 and 1.5 mm. The resemblance is so close that I have no doubt that the Texas shell belongs to the same genus, and should be called *Horatia* (*Hauffenia*) *micra* (P. and F.).

*Horatia* seems to belong to the subfamily *Lyogyrinae*. The operculum resembles that of *Lyogyrus*. I would be less disposed to admit that our shell belongs to this Dalmatian and Italian genus if it were not that two Dalmatian freshwater genera, *Emmericia* and *Lanzonia*, have very close relatives in the Panuco River, northeastern Mexico; also the terrestrial genus *Coilostele*, elsewhere known only in Mediterranean countries, has a species in northeastern Mexico.—H. A. PILSBRY.

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NOTE ON *BIFIDARIA MINUTA* ST.—The name given to this species, NAUTILUS, Jan. 1916, p. 105, was used by Pfeiffer in 1842, his "*Pupa minuta* Say" being a *Bifidaria*. I propose therefore to change the name of my species to *Bifidaria carnegiei*.—V. Sterki.

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MT. MONADNOCK SHELLS.—After sending you the Monadnock list (p. 57) we got a specimen of *Polygyra monodon* Say, the very young of which, in the first list, had been identified at the museum as *P. palliata*.—W. H. Dall.

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#### EDGAR A. SMITH.

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Edgar Albert Smith F. L. S., keeper of mollusks in the British Museum, died on July 22, at the age of 68. He was the son of Frederick Smith, the entomologist. Smith joined the British Museum in 1867, the year after the acquisition of the important collection made by Hugh Cuming, with the arrangement of which he was occupied for many years. On the removal to South Kensington it fell to him to install the large collection in the shell-gallery, which he carried out to the great benefit of the many collectors and students of shells who continuously visit the Museum. On this collection he published over 300 papers and monographs. He became assistant-keeper in 1895, received the I. S. O. in 1903, and retired in 1913. He was Past-president of the Conchological and of the Malacological Societies. His extensive knowledge of conchology and of the collections under his charge, and the friendly help he was always ready to give will cause his loss to be regretted by a wide circle.—*Museum Journal*.

# THE NAUTILUS.

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## THE ANATOMY OF THE NAYAD HYRIOPSIS MYERSIANA (LEA).

BY DR. A. E. ORTMANN.

*Hyriopsis myersiana* (Lea). Simpson, Descript. Catal. 1914, p. 212.

The Carnegie Museum of Pittsburg has received, from Dr. B. H. Bailey (Cedar Rapids, Ia.) two shells with the soft parts, and the soft parts of a third one. One of these with shell is a female, the others are males. They were collected by Dr. E. B. McDaniel at Petchaburi, Siam.

The genus *Hyriopsis* Conard, 1853, has been defined only by shell characters, and the anatomy was unknown hitherto. Simpson (l. c. p. 207) has placed it in the vicinity of *Lampsilis*, apparently relying on the similarity of the shell to that of *Lampsilis* (*Proptera*) *alata* (Say), which is a *Lampsilis* shell.

The soft parts at hand exhibit the following characters :

*Branchial opening* separated from the *anal* by a complete gill-diaphragm, but not by a mantle-connection. *Anal* and *Supra-anal* openings of about the same length, separated from each other by a well developed mantle-connection of moderate length, shorter than either. *Anal* opening with inner edge nearly smooth ; *Branchial* opening longer than the *anal*, with strong, irregular papillae on inner edge. In front of the *Branchial*, the inner edge of the mantle becomes smooth. *Palpi* subfalciform, long, posterior margins connected for about half their length, and connected with the inner face of the mantle for about one third of their length.

*Gills* long and wide, the inner the wider, chiefly so anteriorly. Outer gill narrowing gradually toward its anterior end, the latter near the highest point of attachment line of mantle. Inner gill narrowing anteriorly very suddenly, with its anterior end about midway between the posterior base of palpi and anterior end of outer gill. Outer lamina of outer gill entirely connected with mantle; inner lamina of inner gills free from abdominal sac, except at anterior end. Behind the foot, the two inner laminae of the inner gills are connected.

The male has in both gills weak *septa*, distant from each other, and incomplete (interrupted), and in the female, they are of the same character in the inner gill. *The whole outer gill of the female is marsupial*, and has distinct, heavy, and crowded *septa*, running parallel to the gill-filaments, forming water-tubes. But these *septa* are somewhat irregular and *interrupted*, chiefly toward the margin, and in the posterior half of the gill, they are rather regularly *interrupted by transverse holes*. The anterior section of the gill has the most continuous *septa*. No heavy mass of tissue is seen at the edge of this gill, which is sharp.

Charged marsupium, embryos, and glochidia unknown.

Color of soft parts (in alcohol) whitish, with black-brown pigment on the edges of anal and branchial openings.

That this species should belong in the affinity of *Lampsilis* (or the subfamily *Lampsilinae*), is out of the question. The whole anatomy is truly that of the subfamily *Unioninae* of the family *Unionidae* (NAUT. 23, 1910, p. 116, and Ann. Carn. Mus. 8, 1912 p. 223, 224). The *Anodontinae* are excluded, since no trace of a thickening of the edge of the marsupial gills is observed.

*However, a remarkable character of the septa of the marsupium is that they are interrupted.* This is an unusual character in the family *Unionidae*, and more regularly found among the subfamily *Hyriinae* of the *Mutelidae* (l. c. p. 225). Yet there is a *Unionine* form known, which has interrupted *septa* in the marsupium, and this is *Gonidea* from the Pacific slope of North America (see: Ortmann, NAUTIL. 30, 1916, p. 50). In *Gonidea* all four gills are marsupial, while in *Hyriopsis* only the outer ones are marsupial: but in their structure they are very closely alike.



Disregarding the interrupted character of the septa, *Hyriopsis* stands rather close to the European *Unio*, but, of course, we do not know whether there is any relation in the glochidia. Altogether, *Hyriopsis* represents a type, probably most closely related to *Genidea*, and undoubtedly belonging to the subfamily *Unioninae*. It surely does not belong to the *Lampsilinae*.

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#### CONSISTENCY IN POPULAR NAMES OF SHELLS.

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BY CHARLES W. JOHNSON.

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I have recently rearranged the exhibition of New England mollusks in the museum of the Boston Society of Natural History, the object being to make it more attractive and of general interest to the public. Trays were abandoned and the specimens placed on three large white tablets which cover the entire surface of each of the horizontal cases ( $2\frac{1}{2}$  ft.  $\times$  5 ft.). Of these cases there are twelve, with drawers below for the large study series. Specimens preserved in fluid are removed from exhibition and replaced by colored drawings of the animals, either natural size or enlarged according to the size of the species. These beautiful drawings were made from the living animal by Mr. J. Henry Blake. The Society also possesses a series of the glass models of the Nudibranches made years ago by the Blaschkas. Small maps of New England, both land and marine areas, on which are marked the localities or areas covered by those species having a limited or restricted distribution, are placed with the species.

This brings us to a question of popular interest, that is, the common names for the more conspicuous shells. The many changes in nomenclature affecting the old, classic, scientific names are a serious handicap towards popularizing conchology; and to attempt to explain why these changes are necessary is not the most enjoyable theme in conchological circles. It therefore seems expedient that some fixed, appropriate, popular name should be applied to the more common species. There have been some excellent names proposed by Dr. Alfred G.

Mayer (Sea-Shore Life, N. Y. Aquarium, Nature Ser. No. 1, 1905) ; Julia E. Rogers (The Shell Book 1908) ; Josiah Keep (West Coast Shells 1911). Professor Keep gave a somewhat popular name to every shell ; but I cannot agree with him in some cases. Why *Polinices* (not Polynices) should be called "moon shell" while *Natica* is made a part of a common name of one species, I cannot see. This name is also used in the Shell Book where the inconsistency in the use of common names greatly mars the value of the work in this respect.

There is one thing we should take into consideration, and that is, there are English names in general use, which may be found in the various dictionaries. Turning to the Century Dictionary under sea-snail, we find the following :—In *conch.* a marine gastropod whose shell resembles a helix, as those of the family *Littorinidae*, *Naticidae* and *Neritidae*. Periwinkle is generally applied to the former, and as the latter has a restricted distribution and is confined to the more tropical waters, it seems therefore that the term sea-snail would be more appropriately restricted to the *Naticidae*. Dr. Mayer gives a pertinent name which combines their nest or "sand-collar" with the shell ; for *Polinices heros* (*Natica* or *Lunatia heros* of authors) the Northern Sand-collar Snail, and for *P. duplicata* the Southern Sand-collar Snail. Local or provincial names that are misleading should not be considered in adapting fixed common names, for example, among the New England fishermen the name "cockles" is applied to the sea-snails (*Polinices*), but in all dictionaries the name cockle usually applies to the various species of *Cardium*.

The name Periwinkle is almost universally used for the species of *Litorina* (generally written *Littorina* the original spelling of the genus being *Litorina*) although Keep uses the term "*Littorine*." The name "Common Periwinkle" should be applied to the original and widely distributed species *L. littorea* and not to *L. irrorata* as in the Shell Book ; to the latter, the name Dotted Periwinkle might be applied. The name Red Periwinkle seems better than "Rough Winkle," for *L. rudis*, for the shell, although usually more or less reddish, varies from a grayish white to a dark brown (var. *tenebrosa*). The Seaweed Periwinkle for *L. obtusata palliata* suggested by Dr.

Mayer is very appropriate from its habit of living among *Fucus* or rock-weed. These are often called simply winkles, although the latter term is often locally applied to a number of gastropods more properly included under *Whelks*.

The Century Dictionary says : A *Whelk* is a gastropod of the family *Buccinidae*, in a broad sense, a *buccinoid* or similar univalve with a spiral gibbous shell, whose aperture forms a kind of spout and whose whorls are more or less varicose or whelked." Illustrations, *Nassa reticulata* and *Nassa obsoleta*. *Keep* restricts the whelk to the genus *Buccinum* using "Chrysodome" etc. for other buccinoids, "Nassa" for the species of *Nassidae* and "Purple" for the species of *Thais* (*Purpura*). With the passing of the genus as used by Lamarck and the preoccupation of the genus *Nassa*, it seems therefore best to adopt the name whelk as defined in the dictionary and apply it to all the buccinoid and muricoid shells. *Buccinum undatum*, the Common Whelk ; *B. cyaneum* the Blue Whelk, *Neptunea decemcostata*, the Ten-ribbed Whelk ; *Colus stimpsoni* (*Tritonofusus* or *Sipho stimpsoni* of authors), Stimpson's Whelk ; *Colus pygmaeus*, the Pygmy Whelk. To the genus *Busycon* (*Fulgur*) has been applied the term Giant Whelks. The most suitable names proposed for the species are Nodose Whelk (*B. carica*), although the var. *eliceans* becomes spinose when adult ; Reversed Whelk (*B. perversum*) ; Channelled Whelk (*B. canaliculatum*) and Pear Whelk (*B. pyrum*). Locally the oystermen call them winkles or wrinkles, while in other localities they are referred to as conchs. The species of *Alectrion* (*Nassa*) might bear the following names based on their habits, Mud Whelk (*A. obsoleta*) ; Sandy-mud Whelk (*A. vibex*) and Sand Whelk (*A. trivittata*). For the common *Thais lapillus* (*Purpura lapillus*) the name Rock Whelk seems more appropriate than "Rock Purple," and the western *T. saxicola* might be called the Western Rock Whelk, *Urosalpinx cinerea* is popularly known as the Oyster Drill.

For the species of *Crepidula* I prefer the term Slipper Shells, as the name implies, to that of boat-shells, quarter-decks or deckers, and the names proposed in the Shell Book seem appropriate. The Arched Slipper Shell for *C. fornicata*, the Flat

Slipper Shell for *C. plana*, and the Cup and Saucer Limpet for *Crucibulum striatum*, also the Tortoise Shell Limpet for *Acmaea testudinalis*.

Among the bivalves there is also much confusion in the popular names, due to the restricted use of the names clam, mussel etc. In New England the Clam is *Mya arenaria* and *Venus mercenaria* is known as the Quahaug. In the New York market the former is called the Soft Shell Clam and the latter the Clam or Hard Shell Clam. The Little-neck Clam is the young of *Venus mercenaria*. The terms Long Clam and Round Clam are also used for the two species. To avoid confusion it seems best therefore to adapt a double name applicable to the entire coast, the Long Clam or Soft Shell Clam for *M. arenaria* and the Round Clam or Quahaug for *V. mercenaria*. To the other species, *Mya truncata*, the name Truncate Clam might be applied. *Spissula solidissima* (*Mactra solidissima*) is usually referred to as the Surf Clam, also locally as the Beach or Hen Clam. *Arca campechiensis* and its Var. *pexata* are called the Bloody Clam from the color of its gills and circulatory fluids. To *Venericardia borcalis* (*Cardita borealis*) Dr. Mayer has given the name Cod Clam, as it constitutes one of the foods of the cod. To the *Astartidae* the term Little Brown Clams seems appropriate and to the species *Astarte castanea* the Chestnut Clam and to *A. undata* the Wavy Clam. *Cyprina islandica* known on the New England coast as the Black Quahaug might also be known as the Round Black Clam. *Solemya velum* has been called by Dr. Mayer the Swimming Clam, from the ability of the animal to move through the water for a considerable distance without touching the bottom. This habit is more fully elaborated by Professor Edward S. Morse in connection with the large Northern Swimming Clam, *S. borealis* (Biol. Bull., xxv, 261, 1913). To the long narrow species the term clam is usually replaced by the word shell, thus *Ensis directus* Conr. (*E. americanus* Gld.) is known as the Razor Shell. The fisherman of New England call it the "Skate rock." To *Siliqua costata* have been applied various names such as Sand-bar Clam, Flat Razor etc. I prefer the name Ribbed Pod-shell. For *Cyrtodaria siliqua* (*Glycymcris siliqua*) the name Northern Pod-shell. *Tageus*

*gibbus* (*Solecurtus gibbus*) has been called the Short Razor Shell. The fishermen at St. Augustine, Fla., call it the "Longarone," probably a Spanish term referring to its length.

The term Mussels usually applies to the family Mytilidae, but is also used in connection with the fresh-water clams (Unionidae). *Mytilus edulis* is universally known as the Edible Mussel; *Modiolus modiolus* as the Horse Mussel and *M. demissus* and var. *plicatulus* as the Ribbed Mussel. The scallops are somewhat unfortunate in their scientific names. The Common Scallop (*Pecten irradians* of authors) is now known as *P. gibbus* var. *borealis* Say. If we have to call our large species *P. magellanicus*, we need not emphasize the fact by calling it the "Magellan Scallop." It is known by our fisherman as the Big or Deep-water Scallop; the latter seems quite appropriate. *P. islandicus* has been called by Dr. Mayer the Arctic Scallop.

Piddock is a well-established English name for the species of the family *Pholadidae*, but it has not been generally adopted in this country, although used in most of the popular works. The name Rough Piddock is applied to *Zirfaea erispata* (*Zirphaea crispata*), the Truncated Piddock to *Barnea truncata* (*Pholas truncata*) and "Angel's Wings" to *B. costata*. For uniformity the name Ribbed Piddock seems more suitable for the latter. The Wood-eating Piddock figured in the Shell Book is a *Martesia*, probably *M. cuneiformis* Say.

It seems hardly worth while at present to attempt more than to give popular names to the common or conspicuous species. It also seems inexpedient to make it general. The idea is to create a greater local interest in the subject; therefore a provincial or faunal list of the common names of the species of the Atlantic coast of the United States seems all that is necessary, leaving the west-coast conchologists to improve their list of common names if they think it desirable. With no national association to take it up, this will have to be done by those interested in the matter, and I shall be very glad to confer with any one taking up the subject.



**THE MISSOURI RIVER AS A FAUNAL BARRIER.**

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**BY PAUL BARTSCH.**

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Several years ago I published a note in "Science" on this topic. It seems that this has not come to the attention of most of the workers who are dealing with fresh-water pearly mussels, and I therefore deem it wise to again call attention to it.

In our work during the Mississippi Valley Pearl Mussel Inquiry, we found that the enormous amount of sediment carried by the Missouri River formed an effectual barrier to the distribution of the *Unionidae*. There, while the Mississippi and its tributaries to the north of the Missouri River teemed with aquatic life, careful search in the Mississippi below the mouth of the Missouri, and the mouth of the Ohio, did not reveal a single living *Unionid*. Dead specimens were also absent on the sand bars south of St. Louis. The heavy load of mud carried by the waters of the Missouri, yielding  $\frac{3}{4}$  inches of sediment in a three-inch tube, probably strangles these and other organisms.

We have, therefore, the curious condition of a river forming a barrier to aquatic animals.

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**SHELL COLLECTING IN THE SIERRA NEVADAS.**

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**BY HERBERT N. LOWE.**

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To see the Yosemite and the groves of Giant Sequoias had been a dream long cherished during my thirty years residence in California. Some dreams come true; and this summer my mother and I drove there, with our "Buick Six" well stocked with camp outfit.

The early part of September is rather a dry and unpropitious time for collecting mollusks in the mountains. Rock piles and moist meadows were the most favorable stations. These lovely Sierra meadows, filled with brilliant wild-flowers and surrounded by noble forests of pine, cedar and fir, are the most charming spots imaginable. One vainly hunts for words to give an idea of the wonderful scenery of the Sierra Nevadas. Each day was simply perfect, with clear warm sunshine and air sweet



with odors of pine and fir ; an experience never to be forgotten by the lover of nature.

Leaving the State Highway at Madera, we struck off through the foothills on the Yosemite Road. About five miles west of Raymond I made my first find of *Epiphragmophora tudiculata* var. *cypreophila* in rock piles near the road. By the amount of effort it takes to find these it seems to be rather a rare species.

At the old mining camp of "Coarse Gold" we stopped for lunch and a few *Physa diaphana* Tryon were found in the nearby stream. Our stop for the night was at "Fish Camp," a most beautiful spot, situated in one of the many Sierra meadows, and headquarters for a large logging camp near by. A diligent search was unrewarded by any molluscan species whatever. However at Wawona, our next stop, I had better luck.

About half a mile south of the hotel is a small springy meadow on a gently sloping hillside. Here under sticks were five live *Vertigo ovata* Say ; *Succinea stretchiana* Bld. and *Pisidium*, all "side by each ;" a few of the very rare *Vitrea* or *Euconulus chersinella* Dall were also found here with *Euconulus fulvus* var. *alaskensis* Pils. A search of the upper end of the north meadow resulted in some fine large *Polygyra loricata* Gld. and *Vitrina alaskana* Dall, also a single specimen each of *Vertigo modesta* var. *castanea* Sterki and *Striatura milium* var. *meridionalis* P. & F.

While in the Yosemite, a hike was taken to Vernal Falls, and on exploring rock slides near there a few specimens of *Epi. tudiculata* var. *tularensis* Hemp. were found in company with a flattened form of *Epi. hillebrandi* which Dr. Pilsbry considers new. In the thick moss near the Falls a few *Vitrina alaskana* Dall had their happy homes. In a small meadow about twenty miles from Yosemite on the Big Oak Flat Road, some fine *Pyramidula cronkheiti* Newc. were living under small logs in company with two *Pisidium* and a *Sphaerium*.

After our two delightful days at Wawona and the Mariposa Grove of giant Sequoias, and four more in the Yosemite, we took the Big Oak Flat Road out of the Valley as far as Crockers, where the Tioga road leads over the pass into the Mono Lake country and Western Nevada. One crosses the pass at an

elevation of ten thousand feet where the snows never melt, and only a half mile from the road is a real live glacier. From the sudden change in scenery on the easterly side of the Sierras one might fancy he was in the Swiss Alps. Mono Lake, over ten miles across, with two volcanic islands in its center, is fair to look upon; but the bitter waters are so charged with alkali that no living creature can exist in it. Surrounded as it is by snow-capped mountains, whose melting snows pour in on all sides, its waters remain absolutely undrinkable. From Lake Mono one travels through sand and sage brush to the lovely pine-forested shores of Lake Tahoe. Here we struck the fine Lincoln Highway leading to San Francisco. We crossed several times the old emigrant trail. One pictured the days of the hardy pioneers of the gold rush of '49, the long trains of oxen toiling up these terrible mountain trails, and contrast the ease of our modern automobile transportation over good roads and comparatively easy grades.

A stop was made by a spring on the Lincoln Highway about twenty-three miles east of Placerville. The *Epi. mormonum* var. *cala* Pils. was found here. Under boards and sticks were *Polygyra columbiana*, *Goniobasis nigrina* (the most southerly locality reported) and a form of *Polygyra loricata*. This makes the third instance on this trip where I noted land and fresh-water species living side by side. On the return south from San Francisco we stopped at Old Monterey to collect a few *Epi. californiensis* in the sand-hills at Point Pinos and *Epi. dupetithouarsi* at Cypress Point. The latter species seems to be getting quite scarce owing to the attentions of the squirrels and the cleaning-up of Cypress Point for picnic parties. All logs and sticks carefully burned up leaves no place for Madam Snail to rear her family. However, after diligent search some very fine specimens of this handsome species were added to my plunder.

For convenient reference a list follows of the species found on this trip.

*Epiphragmophora tudiculata cypreophila* Newc. Rock piles five miles west of Raymond.

*E. tudiculata tularensis* Hemp. Rock slides near Vernal Falls.

*E. hillebrandi yosemitensis*, new subspecies. Rock slides near Vernal Falls.

Darker in color than typical *hillebrandi*; more depressed in form, and with a much wider umbilicus. The three specimens found measure as follows :

Altitude 11	diameter 26	mm.
“ 10.2	“ 23.5	“
“ 10	“ 25	“

*E. mormonum cala* Pils. Near Spring on Lincoln Highway.

*Polygyra columbiana* Lea. Near Spring on Lincoln Highway.

*Polygyra loricata* Gld. New variety? on Lincoln Highway.

*Polygyra loricata* Gld. (typical). Under sticks on edge of Wawona Forest.

*Succinea stretchiana* Bld. Wawona meadow.

*Vertigo ovata* Say. Wawona meadow.

*Vertigo modesta castanea* Sterki. Wawona meadow.

*Striatura milium meridionalis* Pils. and Ferriss. Edge of Wawona Forest.

*Zonitoides arborea* Say. Meadow south of Wawona, also Big Oak Flat Road.

*Pyramidula cronkhitei* Newc. Edge of Wawona Forest ; also Big Oak Flat Road.

*Euconulus fulvus alaskensis* Pils. Edge of Wawona Forest.

*Vitrea chersinella* Dall. Meadow south of Wawona.

*Vitrina alaskana* Dall. Big Oak Flat Road and Moss near Vernal Falls.

*Physa diaphana* Tryon. Stream at “Coarse Gold.”

*Planorbis umbilicatellus* Ckl. Big Oak Flat Road.

*Goniobasis nigrina* Lea. Spring on Placerville Road.

*Pisidium abditum* Hald. Big Oak Flat Road.

*Pisidium occidentale* Newc. Big Oak Flat Road.

*Sphaerium occidentale* Prime. Big Oak Flat Road.

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#### NOTES.

PLANORBIS DILATATUS AND P. SAMPSONI. Besides its greater size, *P. sampsoni* differs from typical *dilatatus* by its very much more widely open umbilicus. The two species seem to be fairly distinct. Various forms which in collections are often referred

to *dilatatus* are still of uncertain status. Among these are some shells hardly distinguishable from *multilineatus* Van., occurring as far east as Ohio and Pennsylvania. There is in eastern Pennsylvania a form more depressed than *dilatatus*, with the periphery sharply angular and central, the lip thin, umbilicus wider than in *dilatatus*; this form may be called *P. d. pennsylvanica* (types 67477, spring near Glenolden, Delaware Co., Pa., coll. by E. G. Vanatta).—H. A. P.

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#### PUBLICATIONS RECEIVED.

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A LIST OF THE LAND AND FRESH-WATER SHELLS OF THE ISLE OF PINES, by John B. Henderson. Annals of the Carnegie Museum, vol. 10, 1916. 35 species are recorded, 28 being land shells. 16 species are special to the island, the two species of *Priotrochatella* and two of *Pineria* being isolated types, not related to the Cuban fauna. The rest are Cuban species, or most nearly related to those of Cuba.

HUNTING MOLLUSCA IN UTAH AND IDAHO, by Junius Henderson and L. E. Daniels. Proc. Acad. Nat. Sciences Phila., 1916, pp. 315-339, 4 plates. This important paper is devoted chiefly to the genus *Oreohelix*. The field chosen is in northeastern Utah and the adjacent part of Idaho, the scene of Henry Hemphill's remarkable finds, which excited the attention of conchologists over twenty-five years ago. Hemphill's localities were rather indefinite, and his material was assorted in such a way as to make the distinction between individual and racial variations uncertain. The expedition of 1915 was therefore devoted to search for his localities and to collecting in the same stations so far as they could be determined. Nearly all of the Hemphill species and other forms were rediscovered, and a large part of the paper is devoted to the consideration of their characters and values, the several forms being illustrated. New forms found were: *Oreohelix hemphilli eurekaensis*, *O. strigosa* form *toolensis*, *O. haydeni corrugata* and *O. tenuistriata*. The discussion of *Oreohelix peripherica* (including numerous Hemphillian varieties) may be mentioned as particularly valuable. In the Oquirrh Mountain but little good material could be found, as the range has suffered severely from fires, and the Hemphill colonies have probably been burned over.

To everyone studying *Oreohelix* this paper is indispensable; but the discussion of variation in its relation to taxonomy, pp. 317-320, will interest all who deal with such problems.—H. A. P.

# THE NAUTILUS.

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## NOTES ON OPERCULUM EVOLUTION.

BY CHARLES HEDLEY.

Australian Museum, Sydney, N. S. W.

Conchological text books describe various styles of opercula such as the concentric, lamellar, unguiculate, multispiral, paucispiral, or articulate. Yet little, if anything, has been said on the inter-relation of these various forms. Woodward and Fischer even warn their readers against trusting to opercula for guidance in classification.

Dr. J. E. Gray had a clearer idea of the homologies and taxonomic value of the operculum than many of his successors. In 1833 he showed that spiral opercula can only grow by rotating backwards on their axes, just as a spiral gasteropod shell rotates backwards with regard to the columellar muscle. He maintained that shell and operculum were morphological twins representing the right and left valves of a pelecypod shell. This hypothesis he supported by the correspondence in the appearance of the operculum early in embryonic life, by the right-hand spiral of the shell reflected in the left spiral of the operculum, or vice versa, by structural resemblance and by the frequent mutual gain or loss in solidity or complexity. The muscle between the columella and operculum may be compared to the adductor muscle of a bivalve, while the operculigerous lobe answers to the mantle.

Among recent writers Thiele supported this view ; on the contrary, Huxley disputed Gray's homology and asserted that the gasteropod operculum was equivalent to the bivalve byssus.

But Houssay in 1884 showed that it would be more correct to compare the byssal gland of the bivalve foot to the mucous gland of the gasteropod foot than to its operculum.

In molluscan ancestry the operculum should be of high antiquity, for not only was it possessed by ammonites, but it exists in the tubicolous worms. Perhaps the valves of a chiton indicate metameric repetition of what in the gasteropod developed as shell and operculum. A detailed history of the growth of the gasteropod operculum is lost in records of geological time. Gray erred in considering the annular operculum to be the simplest pattern. It is here advanced that its apparent simplicity is that of degeneracy. The round, multispiral, horny operculum worn by *Pleurotoma* and *Trochus*, though actually far advanced, is yet the most primitive operculum found among recent gasteropoda.

From a gland that secretes new matter on its growing edge, this multispiral operculum must be carried backwards rapidly. By "rapidly" is meant that it describes many revolutions in a lifetime. Let rotation be slowed down, and the product will be the paucispiral operculum. To maintain this kind of operculum with an area equivalent to that of the multispiral type, each spiral has to be greatly broadened. The shape has now changed from round to oblong. So starting from a round, quickly-turning operculum, the first stage in evolution, or retrogression, produces an oblong, slowly-turning operculum. It is suggested that this type of operculum is associated with forms like *Littorina*, *Cerithium* or *Natica*, in which other organs, such as the gill plume, radula or nervous system have not attained extremes of differentiation.

Again, let rotation continue to slow down, till the operculum ceases to revolve upon its muscle. The product, an operculum without axial movement, may now proceed along different lines of development. In one direction it adds fresh growth upon all sides and becomes concentric as in *Vivipara*, *Vermctus*, or *Charonia*. In another direction the increase is confined to one side and may result in a lamellar operculum like that of *Thais*, or an unguiculate one like those of *Strombus* or *Pyrene*. I expect that when traced to early stages, both the lamellar and ungui-



culate types will be found to arise from paucispiral nuclei. These extremes of operculum development are seen to be correlated generally with advanced development of other organs. A final stage is here apt to occur in which the operculum is altogether lost.

The course of evolution here sketched has not marched regularly through the gasteropod phylum. On the contrary it is suggested that in several different groups the operculum has strayed independently along this road of degeneracy.

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A SHELL HUNT IN THE BLACK RANGE, WITH DESCRIPTION OF  
A NEW OREOHELIX.

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BY JAS. H. FERRISS.

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A stop-over at Deming in the summer of 1915, to shake hands with Dr. Swope, deflected the firm of Pilsbry & Ferriss in their snail explorations from the Mogollon Mountains, via Silver City, to the Black Range, via Cook's Peak. Samuel D. Swope, M. D., promoter of civic prosperity, friend of conservation and science, knew the unexplored snail country, and with bake ovens and tactful advice sent us to the biggest mountain range in New Mexico.

Cook's Peak, one of the earliest land-marks of California overland emigrants, interesting botanically and historically, had no encouragement for us in conchology. At the post office of Swarts, on the Mimbres river, we transferred from a heavy wagon and its mule team to a pack train of horses, sufficient for two ladies, two men and a camp outfit. In that exchange we got Teodoro Solis, formerly of Chihuahua, the best packer and camper alive.

A large colony of *Ashmunellas* was found in the foot hills. The next day at Mitchell Gray's mining cabin on Silver Creek, well up the side of Sawyer's Peak, both *Ashmunellas* and *Oreo-helix* came out to meet us a few feet from camp. We reveled here a week or so with the snails of Sawyer and then followed the continental divide northward, Sierra county on the right, Grant county on the left.

At the Reed ranch, head of Black Canyon, I was left to finish the Black Range alone. The Doctor had made engagements in California and the ladies had schools and conventions calling them to Joliet. Teodoro safely loaded my companions into an auto at the Hot Springs resort and upon his return the work was continued for another month by way of Black Canyon, Diamond Creek (where we were detained briefly by enormous speckled trout), then over the range eastward, making our first camp at the ranch of Teodoro's brother near Chloride.

This was the forest primeval. The trail ran about nine to ten thousand feet in elevation and the yellow pine, Douglas fir, spruces and quaking asps were large and thick. It was our highest and wildest range to date. The cattle, wild and keen of scent, are trapped for slaughter in corrals with swinging gates, something like monster turkey-traps. Black and silver-tipped bears, and mountain lions were plentiful. A couple of untamed, off-the-reservation Apaches also were hiding in what seemed to be our best snail coves. We saw one a few seconds but did not catch him. Deer and turkey were fairly abundant, and the whole country is marked by interesting historical events. Near here Dr. Fewkes had dug some of his most valued specimens of prehistoric pottery. At one point a train of pack burros had rolled down into the Las Animas country. During our short stay two saddle horses also rolled down into that cavern of lost souls. In one of the gulches the bones of an unknown soldier had lain so long his clothing and a roll of money were destroyed by the weather. On the Kingston trail a bear dropped out of a tree upon a packer and killed him. Here Apache Kid had robbed and burned a miner's cabin, and at another point, lying in wait behind a rock, he shot a miner in the back; and when we dropped down into Chloride we met the men who followed this same Apache Kid into the San Mateo range and killed him—saw the mule that packed their dunnage, and located the men in Chicago who sent Kid's head to the Yale skull and bone fraternity. Also saw the carcass of a bull that killed a ranch-owner's saddle horse, and was killed and pried off the angry and pompous owner by an efficient cowboy.

I soon found myself in the whirl of Black Range society. Off

upon an independent excursion of my own a mad cow obstructed the right of way. The law was upon my side but I knew the peculiarities of Spanish half-breed cattle well enough to get behind a tree, and did my best. Going around the tree rapidly, I kept behind it all but once and then in a fleeting second was fairly introduced. Grasping her heartily by the horns, I shook them; but the impulsive creature was really overwhelming in her attention, and upon her knees walked all over me. This spot is now marked, and it is quite a large one. Luckily the same cowboy with his 45 that killed the bull, came up the trail and with a bang released me from further embarrassment. Pride only received a jolt. My horsehide coat was cow-proof.

Again when alone, and my thoughts were far away, just at dusk, a robust mountaineer from the Great Smokies came into camp to show me the mummied right hand of the last man who climbed the trail to take him back to Tennessee. As a stranger, and a little timid, it was my part to show that I had no particular interest in the specimen; but those mountaineers possess keen insight into the minds of the tender-feet and I presume the camp site is marked also. However, the dwellers of the high and lonesome will never find the spot where I lay out the rest of the night watching to see if that uncanny naturalist was coming back with any more fragments of his specimen.

After leaving the limestone gulches of Sawyer Peak, shells were rare. Sonorellas take kindly to granite; but there are no Sonorellas in this range. Ashmunellas are also friendly to granite; but the Oreohelix split. *Ore. cooperi*, the quaking-aspid fiend, and *Ore. depressa*, are found in all rocks and under down timber; but *Ore. metcalfi* and *Ore. chiricahuana* never leave the limestone, neither do any of the Holospiras. Very seldom also have any two of the same genus been found in the same colony. Never with Holospiras, and with Ashmunellas only when a toothed and a toothless form come together. In the Black Canyon region I found a very few individuals of *Ore. cooperi* in with colonies of *Ore. depressa* and we also found this great rambler occasionally in the limestone with colonies of *Ore. metcalfi* on Sawyer. In Southern Arizona we have found two and

three species of Sonorellas in large slides. As a rule it is one species at a time in the south-west, and it is a surprise, great luck, if more than one genus of those noted above turn up in any one colony. With the little fellows it is different. They have some peculiarities, but as a rule go it as they please, hit or miss.

In the limestone foothills, while mining, Teodoro had seen shells. We went to the exact spots, both at Chloride and Hermosa, but no traces of shells were there. The fumes of the smelters, blasting, chickens, loss of timber, disease, starvation or something, had removed them from that vicinity. In a hill on the Little Palomas I found two bones of *Oreohelix*, but two hours of hard digging did not find any more signs. Of *Holospiras* there were plenty.

At Chloride the proprietor of the Oliver mines told us he had seen fossil shells deep in the dirt at his camp. Here seemed to be a good place to get at least well-preserved bones, and after our return from a side trip to the Cuchillo range, Monticello, Animosa Canada and the San Mateo range, we visited Mr. Oliver's camp. This happy spot is located on Mineral Creek, five miles above Chloride, in a narrow belt of limestone. Under the limestone spawls and fallen timber live shells were abundant. We ate our lunch at a maiden-hair spring, picking shells and water cress during the process. The fern (*Adiantum capillus-veneris*) had pinnae an inch wide, a form that has been wrongfully catalogued from the Grand Canyon of Arizona as *A. tenerum*, the Florida species. A branch of the stream southward, with hard limestone and a dry hillside, had no shells. The belt northward was not examined.

I returned to Deming via Hermosa, Las Animas Canyon, Hillsboro, and Kingston. The story of the findings will be told jointly in another article, but I desired to name this ribbed, gaudy and hard-to-find species of Chloride all by myself, in honor of one who has encouraged me so much to spend more than thirty of my vacations in bear, cow and catamount countries:—

OREOHELIX PILSBRYI, n. sp.—With numerous spiral beaded cords, this belongs to the *haydeni* school of sculpturing. In

color it is unevenly blotched white and horn color, a few examples opaquely white. When blotched or mottled, the cords and growth wrinkles are often white, thus intensifying the contrast between the two colors. Spire elevated, whorls depressed and sharply carinated. Spiral cords from 5 to 9, with two strong cords or one strong cord between two smaller cords, above the periphery. Fine spiral striae between cords, strongest on the under surface. Growth wrinkles strong, 2 to 6 per mm., a large wrinkle about every one and one-half mm. gives the under surface a checkered effect. Whorls  $4\frac{1}{2}$ , umbilicus small, funnel-shaped, not cylindrical, all whorls visible to the apex. Embryo whorls  $2\frac{1}{2}$ , darker-colored, smoother than later whorls but plainly marked by spiral cords and oblique growth wrinkles. Mouth oblique, and in older individuals lip sometimes stained yellow. In the aged the last whorl often drops half below the periphery.

Alt. 10, diam. 17.5 mm. (No. 112918a, A. N. S. P.)

“ 11, “ 18 mm.

Type specimens in my own collection and in the Academy of Natural Sciences of Philadelphia.

These shells had an enemy which broke an irregular hole in the upper surface of the shell, about 2 mm. in diameter. I have not noticed this form of destruction in other colonies of land shells.

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#### THE NATURE OF THE CONICAL BODIES ON THE MANTLE OF CERTAIN NUDIBRANCHS.

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BY W. J. CROZIER.

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Contributions from the Bermuda Biological Station for Research, No. 57.

A study of the supposed “warning” coloration of brilliantly pigmented nudibranchs as represented by *Chromodoris zebra* Heilprin, has incidentally made clear the previously unknown significance of the “white conical bodies” which occur on the posterior ventral surface of the mantle of this species and give it a beaded appearance. Since white nodular structures of a presumably similar character have been noted upon the mantle



edge of other tropical nudibranchs, the function of these organs as worked out in *C. zebra* is probably identical among all the species in which they occur.

The bodies in question are in fact glands, which store a special secretion concerned in protecting the nudibranchs from the attacks of preying enemies. They are, in a functional sense, comparable to the repugnatorial glands of the littoral pulmonate *Onchidium*, although their mode of action is different. They occur, usually 5, 6 or 7 in number, immediately over the "tail." In some instances 10, 12, and even as many as 19, of these organs have been noted. The manner of their distribution strongly suggests that 5, and in some cases 7, specialized regions exist which give rise each to one of the conical bodies. The central gland of the 5 or 7 is situated in the median plane of the body. It is significant that the increased number of the organs, when they exceed 7, is usually (if not invariably) associated with some injury, such as would be occasioned by the bite of a fish, which has removed a portion of the gland-forming area of the mantle.

Not all the bodies on a single animal are of the same size, one or more being sometimes quite minute. The definite pattern according to which they are arranged is preserved even in cases where one or more of the glands is totally suppressed.

Each of the glands is provided with a pore. In rare cases two pores have been found upon a single gland. The pores are surrounded by a sphincter. When *Chromodoris* is violently disturbed in any way, its consistent reaction is to withdraw the gills and rhinophores, to erect the lateral edge of the mantle, and to turn under, ventrally, the posterior part of the mantle bearing the glandular organs. At the same time the glands become turgid, through the contraction of their muscular investment, the pores being then more prominent. If the irritating stimulation is continued, there issues from the pores of one or more of the glands a white creamy secretion, which is not dissolved by sea water. It is composed mainly of globules of an oily substance. The secretion is not acid, but is neutral to litmus.

When the glands are stimulated individually with induction



shocks, they respond by pouring out their secretion, and the same reaction occurs, on stimulation, when the portion of the mantle which bears them is detached from the rest of the animal.

Chromodoris behaves with reference to these organs in such a way as to point to their importance in the animal's economy. The characteristic ventralward inbending of this portion of the mantle, so different from the boldness with which its lateral borders are thrown into prominence when the creature is disturbed, inevitably suggests a reflex of a protective kind. The nature of the conditions which determine their discharge leads one to regard the glands as repugnatorial in function. Careful study of the results of feeding these mollusks to fishes and various invertebrates has demonstrated that these bodies cannot, however, represent the sole source of offensive secretions. A repulsive material, histologically and microchemically resembling that found in the conical glands, constitutes in fact part of the secretion which proceeds from the whole integument of Chromodoris, but particularly from the lateral portions of the mantle. It is noteworthy that in many individuals there are to be observed, especially over the region of the mouth and tentacles, minute white bodies occurring on portions of the ventral mantle surface remote from the conspicuous white papillae. These bodies also give rise to the white secretion. Such facts lead one to consider that the glands at the posterior end of the animal are merely the expression of a specialized development of the repugnatorial function which is the common property of the whole dorsal and lateral integument. The exposed location of the papillae also negatives the supposition that the glands may be the primary seats for the elaboration of the repugnatorial material, to be secondarily transported to other regions of the animal's surface. As a matter of experimental test, these nudibranchs when totally deprived of the beaded area of the mantle remain unimpaired in their ability to develop a protective distastefulness for fishes and invertebrates.

The repulsive character of the contents of the glands is readily established by controlled feeding tests in which food fragments are smeared with the secretion. Such morsels are invariably rejected. It remains doubtful, however, if this emulsion

of substances represents the only repugnatorial material possessed by *Chromodoris*. It seems possible that the oily element of the secretion is particularly involved in the production of the curiously penetrating odor which the nudibranch emits, and that some other substance is also concerned in determining the general distasteful quality.

Incidentally, the glands cannot be implicated in any mutual attraction between individuals at the time of pairing, for animals from which the glandular equipment has been completely removed, are found to mate readily and deposit normal egg masses.

I have commented above on the suggestive appearance of protection evidenced by the inturning of the posterior beaded border of the mantle. A closer analysis shows, however, that any protection which is in this way afforded to the conical glands is purely incidental. For if the projecting "tail" of the nudibranch is stimulated (as with induction shocks), the beaded portion of the mantle is not rolled under upon itself, but is spread out so that the openings of the glands point in the general direction of the irritated area. Their discharge under these circumstances may occasionally be seen. I therefore believe that the ventralward inflection of the gland-bearing portion of the mantle is primarily a reaction having to do with the normal discharge of the glands. When the nudibranch is attacked at the side, or anteriorly, the glands are thus given an opportunity to discharge a part of their contents in an appropriate direction.

A full account of these observations will be published later.

*Agar's Island, Bermuda.*

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#### THE ANATOMY OF *CONTRADENS CAMBOJENSIS* (SOW.) (NAYADES).

BY DR. A. E. ORTMANN.

Two specimens, male and gravid female, from Petchaburi, Siam, are at hand, received from B. H. Bailey, and collected by Dr. E. B. McDaniel.

These specimens agree very well with *Unio cambojensis* Sowerby (Conch. Icon. 18. Unio. 1866, pl. 42, f. 231), in general

shape, color of inside (rose color), and sculpture of outside. Frierson, who has seen these shells, also thinks that they belong to this species.

Simpson (Descript. Catal., 1914, p. 1013) makes this a synonym of *U. rusticus* Lea (1856), and places it in the genus *Nodularia*. But Lea's shell is larger, heavier, has more elevated beaks, and coarser and more obscure sculpture. This is also evident from the figures of *rusticus* given by Haas (Syst. Conch. Cab. 9. Heft 44, 1911, pl. 21, f. 2-5, where the species is placed in the genus *Contradens* Haas.

Haas (l. c. Heft 48, 1913, p. 173) defines this genus by the sculpture of the shell, and chiefly by the character of the hinge teeth, and describes the anatomy of two species (*C. hageni* Strub. and *verbecki* Bttgr.), which agrees fully with that of the European *Unio*. However, the glochidia are peculiar in not having a spinulose, triangular hook, but a swelling of the lower margin covered with fine spinules arranged in vertical rows. (This undoubtedly is a primitive structure, which, in its further development, leads to the hook of *Unio* and of the *Anodontinae*). Of the septa, Haas says that they are "well developed."

*Anatomy of my specimens of Contradens cambojensis:*

*Anal opening* separated from the *supraanal* opening by a moderate mantle connection; *supraanal* very short, anal with inner edge nearly smooth; *branchial* opening with papillae on inner edge. Anal and branchial openings separated by a gill-diaphragm, of the normal *Unionid*-type. No special structures on mantle edge in front of the branchial opening. *Palpi* sub-falciform, large, their posterior margins united for two-thirds or almost three-fourths of their length.

*Structure of gills Unionine*, but in the male and in the inner gill of the female, the septa are extremely weak and scarce, almost absent.

*The outer gill of the female is marsupial* in its whole length, and when charged, moderately swollen, with sharp edge. *Septa* are present, and stand close, forming water tubes, *but the septa are incomplete, interrupted*, so that the water-tubes (ovisacs) communicate with each other. In the charged and distended marsupium, the septa practically are replaced by rows of somewhat

irregular, subcylindrical, transverse pillars between the two laminae. This interrupted character extends through the whole gill, and by the arrangement of these pillars in rows, parallel to the gill-filaments, their homology with the septa of the *Unionidae* is indicated. There are no secondary water-tubes.

The *glochidia* (pl. 4, fig. 10) fill the whole interior reticulate space in the gill, and they do not stick together so as to form distinct placentae. *Their shape is very peculiar*: transversely elliptical, nearly kidney-shaped, *i. e.*, the outline is subelliptical, with one long side of the ellipse slightly cut away by the hinge margin. Thus they are much longer than high: L., .025, H., .021 mm. In addition, on the posterior end (the end nearer the adductor muscle), there is a gentle emargination, but only on one valve (right or left?), thus producing a slight gap on the margin. The ventral margin does not show any indications of a thickening or of the presence of spinules (such as figured by Haas in *Contr. verbecki*, pl. 22, f. 4).

There is no question that, according to shell characters, this species ought to be placed in Haas' genus *Contradens*. Also the anatomy agrees up to a certain point, with the exception, that here we have not "well developed" septa in the marsupium, *but the septa are perforated or interrupted*. This is a condition previously observed in the *Unioninae*: *Hyriopsis* and *Gonidea* (see Ortmann, NAUTILUS, 30, 1916, p. 86 and p. 50). It is possible that Haas has overlooked this character, and that a similar structure is more often found in Asiatic *Nayades*. At any rate, Haas' figures of horizontal cross sections of the gills of *Rectidens prolongatus* Drouët (pl. 26, f. 4) and of *Acuticosta chinensis* Lea (pl. 30, f. 7) suggest this (text not yet published). And further, the *glochidia* of *Contr. verbecki* (Haas, pl. 22, f. 4) are entirely different, as mentioned above.

For the present it is well to leave this species in Haas' genus *Contradens*, but for the final arrangement of these and the allied forms, the following facts are paramount:

1. According to its general anatomy, it belongs to the subfamily *Unioninae* of the family *Unionidae*.

2. The perforated or interrupted character of the septa of the marsupial gills is a peculiar feature, which has been observed in this subfamily, only in the West American genus *Gonidea*, and in the Asiatic genus *Hyriopsis*, but which is a general character in the subfamily *Hyriinae* of the family *Mutelidae* (South America and Australia).

3. The *glochidia* are quite peculiar, differing from those described for *Contr. verbecki*, and being dissimilar to any known *Nayad* glochidium.

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## RAFINESQUE'S GENERA OF FRESH-WATER SNAILS.

BY HENRY A. PILSBRY.

The rules of nomenclature now in force allow the resurrection of some generic names which were formerly thought to be dead and buried, among them several of those of Rafinesque. It seems desirable, therefore, to fix the types of all of them, so that inevitable changes, however unwelcome, may be made, once for all.

Rafinesque has the reputation of having been a misunderstood and neglected genius. It is lucky that we had few such geniuses. One or two others would have practically scrapped the nomenclature of our fresh-water shells. But science is democratic. Fool, lunatic and savant have the same consideration in nomenclature. This is not the fault of the rules; it is inherent in democratic institutions.

Returning to Rafinesque, we may fairly claim that he was versatile, an all-around zoologist and botanist, besides several other things. In common with Lamarck and others of his school, he saw clearly that the vast increase in the knowledge of nature in the half-century since Linnaeus demanded an expansion of the Linnaean generic system.

His best work was apparently in ichthyology. In writing of mollusks he seemed unable to express himself clearly, either in English or French. His generic descriptions are often mere words. One gains an idea of what he was driving at with the greatest difficulty. Each diagnosis is a cryptogram. What wonder that really scientific zoologists of the time, such as Say,



Lea, Barnes, turned from his writings bewildered and contemptuous.

Enthusiastic lover of Nature, indefatigable explorer of wild and sparsely peopled regions, in advance of his time in taxonomic instinct, Rafinesque missed being a zoological genius by his obscurity of expression, his careless haste and his incurable confusion of ideas.

This seems a heartless estimate of a life devoted to science ; but for the time being, I speak impersonally, and merely of his relation to molluscan nomenclature. His high spirit under crushing misfortune, that is beyond praise.

MELANIDIA Raf., *Analyse de la Nature*, 1815, p. 144. Substitute for *Melania* Lamarck, therefore taking the same type, *M. amarula* (L.).<sup>1</sup>

PHYSINA Raf., loc. cit., substitute for *Physa* Drap., type *Physa fontinalis* (L.).

LAPHROSTOMA Raf., loc. cit., substitute for *Neritina* Lam., type *N. melcagris* Lam.

VIVIPARELLA Raf., loc. cit., substitute for “*Vivipara* Lam.,” type *Helix vivipara* Linn. = *Viviparus vivipara* (L.).

PLEUROCERA Raf., *Amer. Monthly Mag. etc.*, III, 1819, p. 355. No species described in the original publication. Subsequently Rafinesque described *Pleurocera verucosa* (*Annals of Nature*, 1820, p. 11) which has been selected as type by Hannibal (*Proc. Malac. Soc. Lond.*, X, 1912, p. 169). This is *Angitrema verrucosa* of Tryon.

ELLIPSTOMA Rafinesque, *American Monthly Magazine, etc.*, IV, p. 42, 1818 ; *Journ. de Physique, etc.*, Bruxelles, vol. 88, p. 424, 1819. Type *E. gibbosa* Raf., selected by Hannibal, 1912 ; *Proc. Malac. Soc. Lond.*, X, p. 168. The prior name *Ellipsostoma* de Blainville was not a generic but a family name, hence does not affect the status of *Ellipstoma*.

The description of this genus recalls *Angitrema* of Tryon's monograph (*Strepomatidae*). Mr. Hannibal has identified *E. gibbosa* Raf. with *Angitrema geniculata* (Hald.), a species not

<sup>1</sup>Types of this and the following three names fixed according to Art. 30, sect. II of the International Code.



known to occur within about 200 miles of the localities assigned by Rafinesque for *E. gibbosa* (Ohio and Wabash), and in a different drainage. Tryon thought *Ellipstoma* was *Anculosa*. Other guesses (we did not call them identifications) made independently by Dr. Bryant Walker and the writer did not agree, and Dr. Dall declined to make a specific identification. It may be that others, with keener discernment, may arrive at a result satisfactory to themselves; but it seems to me unwise to base nomenclature upon a diagnosis of such doubtful application.

*Ambloxis* Rafinesque, Amer. Monthly Mag., III, p. 355, 1818. The diagnosis of this genus agrees better with the group usually known as *Melantho* or *Campeloma* than with any other of the region, and no doubt it had the species *subsolida* Anth. or a related form as a basis. Rafinesque mentioned, but did not describe, *A. eburnea* and *A. ventricosa*. Mr. Binney, in Land and Fresh-water Shells II, p. 45, figured *Lymnula ventricosa* and *Lymnea eburnea* from Rafinesque's MS. work Conchologia Ohioensis, both being placed in the synonymy of *Melantho decisa*. Binney mentions also, that *L. eburnea* was figured under the names *Ambloxis*, *Amblostoma*, or *Lymnulus major*, or *Lymnea eburnea*, by Rafinesque, in the MS. work mentioned.

I select, therefore, the species *eburnea* Raf. as type of the genera *Ambloxis* (Raf., 1818) *Amblostoma* (Raf. MS. in Binney, 1865) and *Lymnulus* (Raf. MS. in Binney, 1865). *Ambloxis eburnea* Raf. appears to be *Paludina subsolida* Anth., or possibly some closely related form. As the *species* was in no way defined by Rafinesque, remaining a nude name until Binney figured it in 1865, it will become a synonym of Anthony's species.

Dr. Theodore Gill (Proc. A. N. S. Phila. 1864, p. 152) recognized *Ambloxis* as identical with *Cumpeloma*, but said that the "insufficiency of the generic diagnosis as well as the want of connection with any *described* species will prevent its adoption." This was before Binney's publication.<sup>1</sup> Tryon (Amer.

<sup>1</sup> Dr. Walker suggests that Gill had seen Binney's advance proofs, and did not make an independent identification. Binney, however, only mentioned *Ambloxis* incidentally.

Journ. Conch., I, 1865, p. 82) identified *Ambloxis* with *Melantho* (of American authors).

As *Ambloxis* has been recognized as "*Melantho*" by three thoroughly competent authorities, Gill, Tryon and Binney, and the latter author has figured a species to serve as its type, it appears that we will be obliged to adopt *Ambloxis* as a generic term to replace *Melantho* and *Campeloma*.

AMBLOXUS Raf., Enum. and Account, etc., 1831, p. 3. Following the description of *Melania rugosa* Raf., and preceding that of *Melania viridis* Raf., Rafinesque wrote :

"I leave the name of *Melania* to the shells with opening obtuse at the end, or they may form the S. G. *Ambloxus*."

In an earlier paper he had mentioned "*Melania* Lam." In the sentence quoted, he defined *Melania* and *Ambloxus* in one and the same phrase, so that they are necessarily identical. The type of *Melania*, *M. amarula* (L.), becomes automatically the type of the subgenus *Ambloxus* Raf., and it is here designated as such.

Neither of the two species of "*Melania*" which Rafinesque defined by diagnoses of less than two lines length, has been recognized. *M. rugosa* is probably one of several plicate species of the region indicated by him, and it will never be possible to say which, as his type-specimen is not known to exist, and no exact locality was given for it. When a complete collection of the shells of Licking River is available, it may be possible to guess at the specific identity of *M. viridis*, which is described thus :

"Suboval, smooth, five spires, end obtuse, opening oblong. Fine shell, one inch, green, from Licking River."

This is clearly a species of *Campeloma* (*Melantho*), a genus which Rafinesque had named *Ambloxis* in 1818. From this, it seems likely that *Ambloxus* was merely a *lapsus mentis* for *Ambloxis*.

In case it be ruled that *Ambloxus* is not equivalent to *Melania* Lamarek, but must be restricted to one of Rafinesque's species, then the type will be *Melania viridis* Raf. ; and *Ambloxus* (1831) will become a synonym of *Ambloxis* (1818).

*Melania virginica* (Gmel.), nominated as type of *Ambloxus* by Mr. Hannibal, was not mentioned or implied by Rafinesque,

is certainly distinct from both of his species, and therefore can not be considered in this connection.

OXYTREMA Raf., Journ. de Physique, etc., vol. 88, 1819, p. 423. No species mentioned. Not identifiable. The description of aperture suggests *Angitrema armigera*, but the shape assigned excludes that species, and also *Io*, which has been suggested by Mr. Hannibal.

CAMPELOMA Raf., loc. cit., p. 423. Monotype *C. crassula* Raf. This species has been synonymized with *Paludina ponderosa* Say, but on wholly insufficient grounds. It is more like *P. subsolida* Anth. which often has the "summit acute." It is not so in *ponderosa*. Moreover, *subsolida* is often sinistral. This condition must be very rare in *ponderosa*. I have never seen a sinistral one, and none is on record. However, nobody could pretend to identify such a specific description positively. *Campelema* becomes a synonym of the earlier *Ambloxis*.

OMPHISCOLA Raf., loc. cit. p. 423. No species mentioned. Under Opinion 46 of the International Commission, no type can be selected for this genus, since no species "can be recognized from the original generic publication." Beck, 1837, selected *Lymnaea glabra* (O. Müll), a species outside of Rafinesque's assigned territory. Dall (1905) suggests that it may have had *Lymnaea reflexa*, Say, as a basis, but does not assign that as type. In my opinion, it cannot be positively identified.

LYMNULA Raf., l. c., p. 423. New name for "*Lymnea* Auct." Type therefore *L. stagnalis*.

ESPIPHYLLA Raf., Jour. de Physique, vol. 88, 1819, p. 423. Monotype *E. nympheola* Raf. Probably imaginary, but suggests *Succinea* slightly.

LEPTOXIS Raf., loc. cit., p. 424. No species was mentioned by Rafinesque, but the terms of the diagnosis can hardly be applied to anything but *Anculosa* or *Somatogyrus*. In his monograph of 1848, Haldeman used *Leptoxis* in place of *Anculosa*; this identification being supported by figures in Rafinesque's unpublished MS., *Conchologia Ohioensis*, possessed by him.

Desiring to retain the name *Anculosa*, I laid the case before several persons, expert in questions of nomenclature, whose verdict was in favor of *Leptoxis*. The type of *Leptoxis* will be *Anculosa praerosa* Say.

CYCLEMIS Raf., loc. cit. Species *C. minutissima* and *C. olivacea*, undescribed. *C. olivacea* here selected as type. Undeterminable, but the type may be *Viviparus intertextus* Say.

OMPHEMIS Raf., loc. cit. Species *O. lacustris* and *O. phaioxis* Raf., undescribed. Type *O. lacustris* here selected; not determinable, but provisionally it might be identified with *Viviparus contectoides* W. G. B. I think that *Cyclemis* and *Omphemis* were based, at least partly, on *Viviparus*.

LOMASTOMA Raf., loc. cit. Monotype *L. terebrina* Raf. Not determinable. Imaginary?

EUTREMA Raf., loc. cit. Monotype *E. terebroides* Raf. Mythical?

DUPLICARIA Raf., Atlantic Journal etc., No. 5, p. 165, 1833. Monotype *D. bonariensis* Raf. = *Chilina fluminea* (Maton).

#### SUMMARY.

AMBLOXIS will have to be used for the genus commonly known as *Melantho* or *Campeloma*; *Campeloma*, and in part, *Ambloxus*, becoming synonyms.

PLEUROCERA replaces *Angitrema* (of Tryon's monograph), at least for species congeneric with *verrucosa*. (*Pleurocera* of Tryon will become *CERIPHASIA* Swainson).

LEPTOXIS will replace *Anculosa*.

All of the other names which I have been able to identify become synonyms of genera of earlier dates.

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#### A COLOR-MARKED EUCONOSPIRA FROM THE PENNSYLVANIAN OF MISSOURI, AND A LIST OF REFERENCES TO COLORATION IN FOSSIL SHELLS.

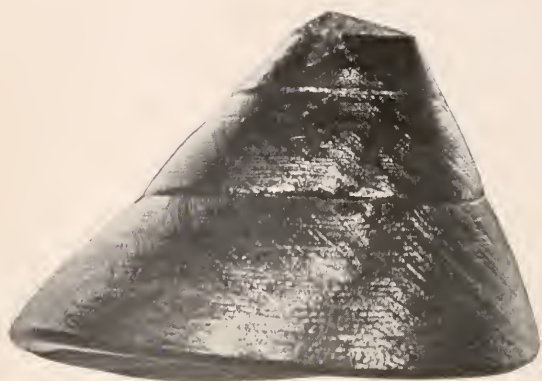
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BY DARLING K. GREGER, COLUMBIA, MO.

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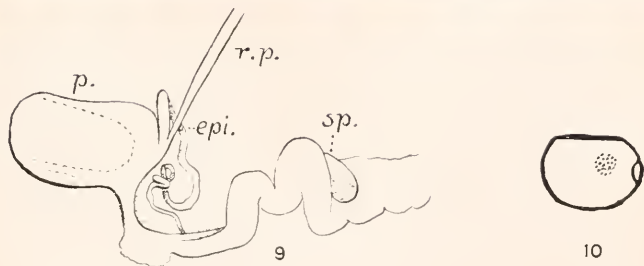
An examination of the extensive series of Pennsylvanian fossils from the vicinity of Kansas City, Missouri, in the University of Missouri collection, brings to light two specimens of gastropods retaining traces of coloration. The material comes from the oölitic layer of the Drum member. The oölite is light buff or gray and the greater number of its many fossils are of the same light color. The shell which I figure on the accom-





GREGER: EUCONOSPIRA MISSOURIENSIS (SWALLOW).





1-4, 8, *OXYCHONA*.

7, *LOBOA BRUNOI* V. IHER.

5, 6, *HOLOSPIRA*.

9, *HEMPHILLIA MALONEI*.

10, GLOCHIDIUM OF *CONTRADENS CAMBOJENSIS*.



panying plate is probably one of the best preserved examples of Swallow's "*Trochus*" *missouriensis* yet collected, and the ornamental color pattern consists of revolving bands, the outer or peripheric band dark, and the inner (upper) one light. On the base of the shell the color is still better preserved; a central umbilical space is light, followed by a dark band. This in turn is followed by another light band, and the outside, or peripheric, band is dark, as on the upper surface. The ornamentation of this species is further increased by a series of still darker curved bands that follow the gracefully curved growth-lines of the shell.

In his description of this species Professor Swallow states that "the surface is highly polished and beautifully cancellated" and that "it still retains its pristine luster." The shell of which he thus wrote is preserved in the University collection (Type No. 928, paleontological collection, University of Missouri) and while its surface is highly polished and exquisitely cancellated only a slight trace of the bands of color that originally adorned it are present.

After removing a mass of oölite by which the base and part of the spire of the figured specimen were concealed, and its beautifully polished surface was revealed, I could well appreciate the feeling of the great English paleontologist, Davidson, who in describing a color-marked Brachiopod says: "When we reflect how vivid, beautiful and varied must have been the tints which once adorned the now black and dingy fossils, we are delighted when by some fortunate accident, some remains of that color is faintly preserved upon a shell which has for almost countless ages been concealed from the sight of man." I will not attempt to suggest what the original tints were that adorned this species; however, the colors as preserved upon the specimen are a light pearl gray and chestnut brown, in the revolving bands, and in the curved rays following the growth lines a dark chocolate brown to black.

In the list of references to coloration which follows, the writer has not in any sense attempted a complete bibliography of the subject. Further search through the German and Italian literature, to little of which he has had access, will undoubtedly bring to light other references.

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**A NEW HEMPHILLIA AND OTHER SNAILS FROM NEAR MT. HOOD,  
OREGON.**

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BY H. A. PILSBRY.

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During an outing at Tawney's Hotel, on the Salmon River, 12 miles from Mt. Hood, elevation 1600 ft., Mr. J. G. Malone found a number of snails, among them a new slug, which may be described as follows.

HEMPHILLIA MALONEI n. sp. Pl. IV, fig. 9.

Most like *H. camelus* externally. The general color is dusky drab, becoming blackish brown on the tail. There are a few small black spots along the sides of the mantle, which has a very large opening exposing the shell. Pneumostome is about

midway of the mantle. Behind the mantle there is a short median impressed line, flanked by obliquely decurrent lines; followed posteriorly by irregular, coarse granulation, the end of the tail then becoming carinate. The pedal furrows rise behind, as in *H. camelus*, and there is no horn above their junction, and no specialized caudal mucous pore. The shell consists wholly of yellow periostracum, whatever lime it contained having been dissolved by the preserving fluid (formaldehyde). The mantle is smooth. Total length preserved in formaldehyde 33 mm.; length of mantle about 16 mm.; width of the sole 4.3 mm. Length of the shell about 10.5 mm.

The short penis (pl. 4, fig. 9) is produced laterally in an ample pocket which contains a large "papilla" attached distally, as shown by dotted line in the figure. There are also some smaller fleshy processes. The penial retractor (*r. p.*) is inserted at the origin of the epiphallus (*epi.*), as in *H. camelus*. The duct of the spermatheca (*sp.*) is narrow, as in *H. glandulosa*. *H. danielsi* Vanatta (Proc. A. N. S., Phila. 1914, p. 367) from Montana differs externally by having a smaller shell pore, and internally by the entirely different shape of the penis, with the penial retractor inserted on the epiphallus. The duct of the spermatheca is wide. The organ figured as a penial gland, in Mr. Vanatta's fig. 2, is apparently homologous with the large lateral penial pocket or sack of *H. malonei*.

Locality, Tawney's Hotel, on the Salmon River, 12 miles from Mt. Hood. Collected by J. G. Malone, August, 1916. Collection Acad. Nat. Sci., Phila., No. 115577.

This species resembles *H. camelus* in external appearance and by having the penial retractor inserted at the apex of the penis. It is more like *H. glandulosa* in the shape of the penis and the slender duct of the spermatheca.

One of the specimens had been extensively gnawed, evidently by the type specimen. Another, which had been confined in the same box, disappeared. Probably the survivors knew where their companion went.

Mr. Malone found the following snails in the same neighborhood:

*Ariolimax* sp. (common, but not collected).



*Epiphragmophora fidelis* Gray.  
*Polygyra columbiana* Lea.  
*Pristiloma* sp., fragment.  
*Circinaria vancouverensis* Lea.  
*Circinaria sportella hybrida* Ancey.  
*Goniobasis plieijera silicula* Gld.

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#### PHILOMYCUS IN ARIZONA.

BY H. A. PILSBRY.

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In the course of our desert journey of 1910, the Santa Rita Mountains, in southern Arizona, were visited. The party (Messrs. Ferriss, Daniels, and the writer) camped at the head of Agua Caliente canyon, somewhat above the 7000-foot contour. A two-day trip was made eastward across Madera canyon, and over the saddle north of Old Baldy, dropping down the eastern slope of the range to about the 6800-foot line. Some slugs picked up here (our Station 17), were thought to be all *Agriolimax*, but on closer inspection, three *Philomycus* were found in the lot. It is a new genus for Arizona; in fact, the place is over a thousand miles southwest of any record in this country. The species may be called *Philomycus (Pallifera) arizonensis*, n. sp. It is 20 mm. long, the sole 1.8 mm. wide. Color: above bister, below snuff brown (in alcohol). Jaw with few ribs. Type and two smaller specimens are No. 115575, A. N. S. P.

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#### HENRY MELVILL GWATKIN.

Professor H. M. Gwatkin, widely known as a special student of molluscan radulæ, died during the first half of November. He was born at Barrow-on-Soar, Leicestershire, England, July 30, 1844, and was educated at Shrewsbury School and St. John's College, Cambridge. He took his B. A. at Cambridge in 1867, and was a Fellow of St. John's College from 1868 to 1874, Theological Lecturer from 1874 to 1891, and Dixie Professor of Ecclesiastical History from 1891 to the time of his death. He was Gifford Lecturer at Edinburgh, 1903-05, and in 1897 re-

ceived the honorary D.D. degree from Edinburgh. In 1882 he published "Studies of Arianism." It is very interesting to find that a man who thus gave his life to theological studies, should have chosen for his hobby such a subject as the radulæ of the mollusca. His collection, which I was permitted to examine when in Cambridge some years ago, is amazingly rich, doubtless far exceeding any other. He was indefatigable in securing material from all over the world, and was able to prepare good mounts from animals long dried in the shell. Unfortunately the shells themselves were not usually preserved, so in case of doubtful identifications there will be no ready means of confirming the assigned names. It is understood that the whole collection has gone to the British Museum.—T. D. A. COCKERELL.

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#### NOTES.

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COMMON NAMES : Speaking of common names reminds me of the time I lived in Branford, Connecticut. I used to hear the name "Squaw Clam" frequently. I found the name originated from the fact that in the duck season the old squaws fed on these forms. So I made up my mind to find out what a squaw clam was. I tried *Mulinia lateralis* with one man: I got "yes, that's it." *Tellina tenera* with another, "yes, that's it," *Macoma* with another, "yes, that's it." I don't know how many species I tried, but I found that squaw clam embraced so many that no genus would hold them.—H. W. WINKLEY.

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LIMAX ARBORUM IN A COLORADO GREENHOUSE.—In a greenhouse at Boulder, devoted principally to the growing of tropical orchids, numerous slugs have recently appeared, and have proved extremely destructive to the plants. I have before me a *Cattleya* flower absolutely ruined by them. There is every reason to believe that the slugs came with a consignment of orchids from Denver, but how they reached Colorado remains unknown. The species is *Limax arborum*, as I was able to confirm from an examination of the penis-sheath, which shows the so-called flagellum very well. The specimens are very uniform, all belonging to the variety *subrufa* LeComte, having the body a rather pale and translucent reddish, mantle with the usual black bands and a nebulous or evanescent median one, back with two grey bands, lateral bands not developed. It seems that this particular form is common in Belgium, and it may be supposed that it reached America with garden plants from that country.—T. D. A. COCKERELL.

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No. 11

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**LOBOA BRUNOI N. G., N. SP., A LAND SHELL FROM THE BRAZILIAN  
ISLAND OF TRINITY.**

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BY DR. HERMANN VON IHERING.

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The present Director of the Brazilian National Museum at Rio de Janeiro, Dr. Bruno Lobo, has rendered to science an excellent service in accompanying, with some employees of that museum, the expedition which in the present year was undertaken by the Admiralty for political and military reasons. It will be a matter of great interest to know the geological and biological results of the expedition.

Dr. Bruno Lobo has kindly charged me with the study of the Mollusca which have been collected by the expedition. I shall give information on the matter in the official publication, but there is one point which I desire to communicate immediately to my competent friend, Mr. H. A. Pilsbry, hoping to hear his opinion. Among the marine shells I have found also a small land shell, which evidently inhabits this island. The shell is quite intact and not worn in its sculpture, but of a chalky white aspect not rare in shells exposed to an arid environment. The shell is of a stenogyroid habitus and seems to me the representative of a new genus of the family Achatinidae. I give here the description accompanied by a figure.

LOBOA BRUNOI n. g., n. sp. Pl. IV, fig. 7.

The shell has a conic-turreted form and is of rather solid texture, perforate, of a dirty chalky-white color. The whorls,

in number  $7\frac{1}{2}$ , are convex and separated by a deep suture. The last whorl is a little longer than the spire, descending only at its end. The apex is obtuse, first ascending then descending, smooth, shining. The two embryonic whorls are sculptured with irregular longitudinal wrinkles and numerous very fine pores, which exist also in some of the following whorls. The whorls of the spire are ornamented with feeble longitudinal ribs which are somewhat irregular and sometimes bifid and with numerous impressed spiral lines. The aperture is small, somewhat oblique, occupying one-third of the total length of the shell. The peristome is sharp, simple, the columellar lip dilated above, reflected, somewhat thickened and covering the umbilical chink. The parietal callus is broad, white, and forms a straight line connecting the outer lip with the columella, with which it forms an obtuse angle.

The length of the shell is 19.5, the diameter 7.3, the alt. of the aperture 6.5, the diameter of the aperture 4 mm.

The unique specimen, found at the Brazilian Island of Trinity, is kept in the National Museum of Rio de Janeiro. The species is dedicated to my distinguished colleague, Prof. Dr. Bruno Lobo, Director of the National Museum of Natural History and Anthropology at Rio de Janeiro.

*House de Joinville, Est. de St. Catharine, Brazil,*  
*20th of September, 1916.*

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#### PLEUROCERA SUBULARE LEA.

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BY CALVIN GOODRICH.

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Lea's *Melania subularis*<sup>1</sup> came from the Niagara river. It is a shell common to the waters of Lake Erie, especially the northern and western shallows. A form, recognizable superficially as different, occurs in the lake tributaries. These river shells, as a rule, are lighter of structure, less polished and, whorl for whorl, somewhat larger than lake shells. The percentage of dark shells in the streams is, I would say offhand, lower than in

<sup>1</sup> Philos. Trans. IV., p. 100; 1831.

the lake. But the differences are so slight that they do not warrant distinction even as a sub-species.

I believe it was this stream form that Anthony had before him when he described his *Melania neglecta*,<sup>1</sup> from the Great Miami river, "near Dayton, Ohio." The descriptions of *subularis* and *neglecta* might be interchanged and cause little or no perplexity to the student. In September, 1916, I collected in the Great Miami at Tadmor, about ten miles north of Dayton, and in January last, collected over exposed gravel bars of the river at Dayton itself. Save that there seem to be an unusual number of distorted specimens among these shells, I cannot see any marked differences between them, and recognized *subulare* of the lake drainage. Anthony mentioned two varieties, one banded, the other "plain, horn-color, or with bands but faintly indicated by an almost imperceptible difference of color in the interior of the mouth." Heavy specimens of this latter variety, with "remarkably expanded outer lip," were separated by Lea under the name *Trypanostoma labiatum*.<sup>2</sup> In the Tadmor lot, I have specimens running from thin attenuated forms to the robust *labiatum* of expanded lip, banded and unbanded, all of the same colony. In a family so variable as the *Pleuroceridae*, there can be little justification for Lea's action, if only because the dignifying of one form with a name makes it a duty to name the other forms—a business that would pile up the nomenclature like ore-heaps around a blast furnace.

*Melania intensa* Anthony<sup>3</sup> is simply a "purple-black" variety of *subulare*. Such shells occur more or less commonly in localities where *subulare* flourishes. I collected nearly a handful in the Wabash river at Logansport, Ind., last year. One can get black and partly black shells. In a sending by A. J. Brown from Spring river, Fulton county, Ark., was a specimen black from apex to a little beyond the beginning of the last whorl. At that point the animal seems to have run out of coloring matter, finishing the shell in pale yellow.

<sup>1</sup> Ann. Lyc. N. Y., p. 128; March, 1854.

<sup>2</sup> Proc. Acad. Nat. Sci., p. 174; 1862.

<sup>3</sup> Reeve, Monog., sp. 371.

In the synonymy of *subulare* may be included *Trypanostoma pallidum* Lea.<sup>1</sup> This is merely an extreme form, such as occurs somewhat rarely among fresh-water Gastropoda. It represents an old-age development, denied to all except a few animals of unusual vitality or unusual good luck in escaping hardships and enemies. Judging by the figure in Tryon<sup>2</sup> (the description suggests difficulties) *Melania tracta* Anthony, placed by Tryon in the synonymy of *Pleurocera elevatum* Say, is the *pallidum* stage of *subulare* growth.

*Pleurocera subulare* is probably the most widely distributed member of its genus, inhabiting from easternmost Ontario to Minnesota, Kansas and Arkansas. East of the Mississippi it does not appear to go below the line of the Ohio river. Considering the variableness of the family, the characteristics of this species are remarkably constant. There is slight difference between the *subulare* of the Great Lakes region and that of streams of northern Arkansas.

The synonymy of this species may be set down as:

*Melania subularis* Lea, 1831.

*Melania tracta* Anthony, 1850.

*Melania neglecta* Anthony, 1854.

*Melania intensa* Anthony mss., Reeve, 1860.

*Trypanostoma pallidum* Lea, 1862.

*Trypanostoma labiatum* Lea, 1862.

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#### A NEW HOLOSPIRA FROM CHIHUAHUA.

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BY HENRY A. PILSBRY.

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HOLOSPIRA BRYANTWALKERI n. sp. Pl. 4, fig. 6.

A species of the subgenus *Haplocion*. The shell is rimate, cylindric, the upper third tapering, summit mucronate. Very pale flesh-colored. Sculpture of closely set riblets, narrower than their intervals, very straight and retractive on the upper,

<sup>1</sup> Proc. Acad. Nat. Sci., p. 173; 1862.

<sup>2</sup> Monograph of *Strepomatidae*, Washington, p. 96; 1873.



arcuate on the lower whorls. There are 43 riblets on the penult whorl. In the conical part of the spire the riblets are partly hollow, and broken down in places. The whorls are quite convex, and in the lower part of the conical portion they overhang a little. The last whorl is well rounded below, and carries the aperture forward shortly in advance of the ventral outline of the shell. Aperture is small, almost circular, a little oblique, with a quite flat, reflected and continuous lip. The internal axis is simple.

Length 19.5, greatest diam. 5.3 mm.;  $14\frac{3}{4}$  whorls remain, the embryonic whorls being broken off. Aperture 4 mm. long, measured outside peristome.

Rio Conchos, Chihuahua, Mexico, not far above its confluence with the Rio Grande, collected by Mr. B. H. King, 1912.

This species is larger than any similarly sculptured *Haplocion*. An entire specimen would have about 17 whorls, with a length of slightly over 20 mm. The holotype is in coll. Bryant Walker, no. 36935.

With the preceding there were two specimens figured in pl. 4, fig. 5, which appear referable to *H. pasonis* Dall. The riblets in the last whorl are slightly closer than in a specimen of the original lot of *pasonis*, but I can find no material difference. They measure :

Length 21.6, diameter in the middle 6.6 mm.;  $11\frac{1}{2}$  whorls.

Length 21.4, diameter in the middle 6.1 mm.;  $11\frac{2}{3}$  whorls.

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#### NOTES ON THE BIFASCIATA GROUP OF OXYCHONA.

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BY H. A. PILSBRY.

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The genus *Oxychona* contains conic, acutely carinate, thin and light-colored snails of eastern Brazil, evidently arboreal, distributed from the Province of Rio to that of Bahia. Although very similar in shape to the Helicid genus *Papuina*, I was led to place the group in the *Bulimulidæ*, near *Drymæus* and *Zaplagius*, by the characters of the teeth and embryonic shell.

Dr. von Ihering, who considered the group in a valuable paper<sup>1</sup> has confirmed this classification.

Having occasion lately to go over the specimens in the Academy collection, it became evident that the synonymy of *O. bifasciata*, the most widely known of them, had been made too comprehensive by Pfeiffer, who has been followed by subsequent authors. Certainly two, probably three species seem to have been lumped; though closely related they appear to be distinct. References to the literature may be found in Manual of Conchology V, p. 128; XI, p. 181; XIV, p. xxxvii, 154.

*Partial Key to species of Oxychona.*

- a* Last whorl descending deeply below the keel in front; shell pitted above the keel and suture; aperture with a rather long "spout," the lip but slightly expanded above it, white; alt. 15, diam. 22 mm., between Rio and Campos, State of Rio de Janeiro. *O. lonchostoma* (Mke.).
- a'* Last whorl not descending in front.
  - b*. Shell higher than wide. *O. gyrina*.
  - b'*. Shell wider than high.
    - c*. Lip above the angle well expanded and calloused within; outlines of spire nearly straight; peristome white or pale pink. *O. bifasciata* (Burr).
    - c'*. Lip scarcely or not expanded above the angle, sinuous.
      - d*. Peristome white or pale pink, basal margin rather wide; "spout" moderately developed. *O. bosciiana* (Fér.).
      - d'*. Peristome rose-colored throughout, basal margin narrow. Spout longer. *O. pyramidella* (Wagn.).

I have not seen *lonchostoma*, *gyrina* or typical *pyramidella*, all of them described nearly a century ago, and not recorded by any subsequent collector. *O. mimarum* is not sufficiently known to contrast with the figured species. Notes on the other species and their subspecies follow.

<sup>1</sup>Analyse der Süd-Amerikanischen Heliceen. Journ. Acad. Nat. Sci., Phila., XV, 1912.

OXYCHONA BIFASCIATA (Burrow, 1815). Pl. IV, figs. 4, 8.

This is described by Burrow as "white with two purplish brown transverse bands and a dark brown apex. Inhabits Pernambuco." The figure, shows the outer lip to be expanded and thickened within; it measures, length 18, diam. 18 mm.

Specimens in collection of the Academy are variously banded (pl. IV, figs. 4, 8), and have two very small dark spots behind the upper lip in two specimens, none in two others. *The upper lip is well expanded, calloused within*, the callous thicker near the periphery, giving the inner edge a sinuous contour. The basal lip is wider than in *blanchetiana*, and the last whorl is barely concave above the keel, not pinched out as in *blanchetiana*. The outlines of the spire are almost straight. In one of the four examples the tip of the apex is dark. In one of the specimens the lip has the faintest roseate tint, which becomes distinct at the columellar insertion. The others have a white lip; and this was no doubt the typical color, as a colored lip would have been mentioned by Burrow.

Length 15, diam. 16.4 mm.;  $6\frac{1}{2}$  whorls.

Length 15.4, diam. 17 mm.;  $6\frac{1}{2}$  whorls.

OXYCHONA BOSCIANA (Férussac).

Férussac's figured type shows dark bands a short distance below and above the periphery, another below the suture; the upper two bands spreading into blotches behind the lip; spire slightly concave, and the latter part of the last whorl strongly so near the periphery, causing the aperture to be conspicuously produced, spout-like. The upper lip is sinuous, and *not at all expanded*. Length about  $16\frac{1}{2}$ , diam. about 21 mm. Lip white.

*Helix bosciiana* was mentioned in the *Prodrome*, but first defined by three figures in the *Histoire naturelle*, pl. 64, fig. 1. This is one of the old plates, drawn by Bessa and engraved by Coutant. I do not know the date of issue, but it was probably not long after 1820.

OXYCHONA BOSCIANA BLANCHETIANA (Moricand, 1833). Pl. IV, figs. 2, 3.

Mem. Soc. de Phys. et d' Hist. Nat. de Genève, vi, p. 539, pl. 1, f. 3.

This is the best known form. Typically it is white above, with two dark blotches behind the lip, but as often there is also a narrow dark band a short distance below the suture, and sometimes an interrupted one above the carina. The base has a band, often split, near the periphery. Upper lip *not expanded*. Lower lip reflected, white or faintly pinkish. Outlines of spire concave. Length 17.4, diam. 19.5, or somewhat smaller.

This form was collected by Blanchet in the environs of Bahia. It appears to differ from typical *bosciana* only in color, and its status as a subspecies is very dubious. It is probably a mere color-form of *bosciana*.

Hidalgo has figured another variety of *bosciana*, collected by the Spanish Expedition around Rio Janeiro, which seems rather out of the range of the species (Viaje al Pacifico, Moluscos, pl. 1). It is evident that the species has various local color-races, about which we know very little at present.

#### OXYCHONA PYRAMIDELLA (Wagner, 1827).

This is a form having the general shape of *bosciana*, with two bands above, one below the periphery of the last whorl. The aperture seems to be produced outward in a narrower spout than in *bosciana*, upper lip apparently not expanding, and the whole lip rose-colored. The habitat given is the province of Bahia, "in sylvis mediterraneis inter montem sanctum et flumen S. Francisci." The figures are rather poor, and series of specimens are needed to determine whether it is to be ranked as a subspecies of *bosciana* or as a distinct species.

#### OXYCHONA PYRAMIDELLA CURRANI Bartsch. Pl. IV, fig. 1.

See NAUTILUS for September, 1916, p. 53. Rio Grungugy, Province of Bahia. Figures of the type of this handsome race are now given. It differs conspicuously from *blanchetiana* by the more pinched keel, the longer external spout of the aperture, more sinuous, broadly rose-bordered lip, and other features fully described by Dr. Bartsch. The microscopic sculpture is the same. It appears to be more elevated than *O. pyramidella*, with somewhat diverse color-pattern.

OXYCHONA MIMARUM Ancey.

*Orychona bifasciata* var. *mimarum* Anc., Le Nat., 1901, p. 93. Pilsbry, Man. Conch. XIV, p. 154. This unfigured form from Minas Geraes is probably specifically distinct. Not seen by the writer.

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A LIST OF MOLLUSKS COLLECTED AT CASTLE ISLAND, BOSTON.

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BY SHIELDS WARREN.

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Castle Island, Boston Harbor, is an interesting collecting ground owing to the number of mollusks that flourish there under the adverse conditions necessarily present in a great seaport. The main channel to the inner harbor passes the island, and every ebb-tide strands much of the water-front debris on its shores. Although the island would seem an unfavorable habitat for even hardy mollusks, it is one of the best collecting places for nudibranchs in the vicinity of Boston. In the early spring considerable numbers come there to breed, particularly *Acanthodoris pilosa* and *Lamellidoris bilamellata*, and I have found scattered specimens of these and other species from October to June.

The shore of the island on the east and south is sand and gravel with scattered boulders, and is sand and mud, with patches of eel-grass, elsewhere. Between Castle Island and City Point are extensive mussel flats; and clay, dredged from the neighboring channel and dumped beside the bridge, contains numerous valves of oysters and quahaugs similar to those found in the excavations for the Boylston Street Subway. *Littorina littorea* is very plentiful on the rocks and is gathered by the Italians for food. The imbricated form of *Thais lapillus* is fairly abundant.

Below is a list of the mollusks I have collected on the island, and which seems to be fairly representative of the whole of Boston harbor. Species marked with an asterisk have not been obtained living.

<i>Ostrea virginica</i> .*	<i>Crepidula plana</i> .
<i>Pecten magellanicus</i> .*	<i>Cingula aculeus</i> .
<i>Anomia aculeata</i> .	<i>Litorina littorea</i> .
<i>Anomia simplex</i> .	<i>Litorina obtusata palliata</i> .
<i>Mytilus edulis</i> .	<i>Litorina rudis</i> .
<i>Modiolus modiolus</i> .	<i>Lacuna vincta</i> .
<i>Modiolus demissus plicatulus</i> .*	<i>Urosalpinx cinereus</i> .*
<i>Clidiophora gouldiana</i> .	<i>Thais lapillus</i> .
<i>Venus mercenaria</i> .*	<i>Alectrion obsoleta</i> .
<i>Ensis directus</i> .	<i>Alectrion trivittata</i> .
<i>Mesodesma arctatum</i> .	<i>Colus stimpsonii</i> .
<i>Mya arenaria</i> .	<i>Aeolidia papillosa</i> .
<i>Saxicava arctica</i> .	<i>Coryphella rufibranchialis man-</i> <i>anensis</i> .
<i>Acmaea testudinalis</i> .	<i>Palio lessonii</i> .
<i>Polinices heros</i> .	<i>Acanthodoris pilosa</i> .
<i>Polinices triseriata</i> .*	<i>Lamellidoris bilamellata</i> .
<i>Crepidula fornicata</i> .	<i>Lamellidoris muricata</i> .
<i>Crepidula glauca</i> .	

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MARTYN'S UNIVERSAL CONCHOLOGIST.

A copy of this rare work has recently been obtained by the Boston Society of Natural History. Bernard Quaritch, in describing this copy in his catalogue, says—"4 vols. atlas 4to, with colored frontispiece, 2 engraved plates of medals and 160 plates containing 322 colored figures. Contemporary tree-calf, neatly rebacked. With the [John] Townly book plate.

"The copy agrees with that in the British Museum (Natural History) and is quite complete. The complete work in four volumes is very rare although the first two are comparatively common. Even Sir Joseph Banks was unsuccessful when endeavoring to obtain the entire work. Evidently Martyn only completed copies by order. Other than the copy offered, only one example has occurred for sale by auction in London since 1895 and I have been able to trace the sale of only eight copies for upwards of 50 years prior to that date. The Roscoe copy sold for £32 2 s. 6d. and the Fonthill example for £52.10 s." The Society's copy cost £21.



Dr. Wm. H. Dall in the Proc. U. S. National Museum, 1905, vol. 29, pages 415-432, gives a very interesting account of Thomas Martyn and an exhaustive description of the first two volumes, containing 80 plates, based on a copy in the U. S. National Museum and a similar copy in the Academy of Natural Sciences, Philadelphia. In the publication, 1907, vol. 33, pages 185-192, Dr. Dall gives some supplementary notes, based on a copy in the library of Mr. John B. Henderson of Washington, also consisting of 80 plates, together with some notes received from Mr. Charles Hedley referring to a four-volume copy in the Australian Museum, Sidney.

The size of the copy in the U. S. National Museum is  $11 \times 12\frac{7}{8}$  inches and the one in the Academy of Natural Sciences is  $12\frac{7}{8} \times 10\frac{7}{8}$  inches, while Mr. Henderson's copy is  $16\frac{1}{8} \times 16\frac{1}{8}$  which is the size of the copy obtained by the Society. The latter copy has in Vol. I, the first and second engraved title pages both dated 1784, the engraved dedication to the King, introduction preface and letter including 39 pages, two plates of medals, and explanatory table of the 40 plates. Vol. II has only the second title-pages same as in Vol. I, 1784, and explanatory table of the 40 plates. Vol. III has only the first title-page, same as in Vol. I, 1784, and explanatory table of the 40 plates. Vol. IV has only the first title-page, same as in Vol. I, 1784, and explanatory table of the 40 plates. Dr. Dall says the first two volumes were issued in 1784, Volume III in 1786 and the work completed probably in the spring of 1787.

In the Society's copy, in the explanatory table for Vol. IV, figure 135 is (*Cochlea*) *denrachates* not *dentrachates* and figure 137 is (*Cochlea*) *caelata* not *cretata* as given in the explanatory table of the copy in the Australian Museum. In the Henderson copy Dr. Dall says plate 59 has two views side by side. In the Society's copy only one view is given. All of the other plates agree with that copy.

In the NAUTILUS, vol. 22, p. 72, Mr. S. S. Berry refers to a copy comprising four volumes in the library of the Leland Stanford Junior University. This work lacks the explanatory table for the plates of the fourth volume. This is apparently the only other set of four volumes in America. In 1913 Mr. Berry

obtained a copy of the first two volumes of this work (NAUTILUS, Vol. 27, p. 95). In the same volume of THE NAUTILUS, page 107, Mr. George H. Clapp, of Pittsburg, described a copy in his library. The two volumes are bound in one and trimmed to  $10\frac{3}{4} \times 13\frac{7}{16}$  inches. The sizes of the bound volumes apparently vary according to individual tastes. The size of the title pages in the Society's copy would not admit of trimming; the plates of medals are about  $14 \times 11$  and the explanatory tables  $11\frac{3}{4} \times 11$  inches; the actual size of the paper on which the plates are printed is  $11 \times 13\frac{1}{2}$  inches, but the ruling or "neat-line" surrounding the shells varies between  $7 \times 10\frac{1}{2}$ . The plates are mounted on a heavy blue-gray paper.—C. W. JOHNSON.

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#### NOTES.

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ASTARTE QUADRANS AS FOOD FOR FLOUNDERS :—While walking along the beach on the ocean side, North of Provincetown, Cape Cod, I chanced to come upon a complete dried skeleton of the common flounder. The flesh had been removed by the beach crustacea etc, so that no muscle or entrails was visible, except the dried ligaments which held some of the bones together. In the space where the stomach had been, was a pile of *Astarte quadrans*, eighty-six valves in number, varying in size from the adult  $9/20$  inch to  $3/20$  inch, all in good condition and the majority having intact the ligament connecting the valves. Not a specimen of any other shell was present, although in the locality where the flounder lives are found several species of small shells.

This shows one of three things, viz :—that this fish had the ability to discriminate; or had found a spot where only this shell existed; or an epicurean fondness for "little-neck" *Astarte*.—J. HENRY BLAKE.

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MR. HORACE F. CARPENTER began in September of 1916 to install his collection of shells in the upper south room of the main building of the Roger Williams Park Museum, Providence, R. I., and at this date upwards of 4,000 species have been placed on exhibition.

# THE NAUTILUS.

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## THE STATUS OF THE GENUS SUBULARIA MONTEROSATO.

BY PAUL BARTSCH.

In 1853, H. & A. Adams published in vol. 1, pp. 237-238 of their work on the "Genera of Recent Mollusca" the genus *Leiostraca*, defining it in the following manner :

"Shell turreted, subulate, flattened, widest from side to side, polished, smooth, semipellucid ; sides with a thin varix extending as far as the apex of the spire ; aperture oblong, entire ; inner lip distinct, callous, slightly sinuous in the middle ; outer lip flexuous.

"Ex. *L. bilineata*, Alder, pl. 25, fig. 3. Shell, *L. Metcalfei*, A. Adams, fig. 3, a.

"The most curious circumstance about the type of this genus is the fact of its being compressed from before backwards, with a varix on each side, as in *Bursa* and *Pythia*.

### "Species of *Leiostraca*.

*acuta*, Sow.

*bilineata*, Alder

*bivittata*, H. and A. Adams

(*bilineata*, Adams and Reeve)

*fulvocincta*, C. B. Adams

*Metcalfei*, A. Adams

*Mindorensis*, Adams and Reeve

*solitaria*, C. B. Adams.

*subulata*, Donov.

*unilineata*, Adams and Reeve

*varians*, Sow."

Since the characters of the genus are based upon the shell, and pl. 25, fig. 3 shows the head of an animal only, while fig. 3a, *Leiostraca metcalfei* A. Ad. shows the shell characters above defined, we may take *Leiostraca metcalfei* A. Ad. as the type of the genus. Even if we were to admit all the species listed by

H. & A. Adams as a possible field for type selection, *Leiostraca metcalfei* A. Adams is the only one that meets the full characterization of their genus, all the others being members of the genus *Strombiformis* Da Costa, 1778.

Unfortunately, Albers, in his *Die Heliceen*, p. 156, 1850, used the name *Leiostracus*, which was considered homonymous with H. & A. Adams' *Leiostraca* by Monterosato in his paper on *Nomenclatura Generica e Specifica di alcune Conchiglie Mediterranee*, p. 103, 1884, where he published the substitute name *Subularia* with the statement "(= *Leiostraca*, H. e A. Adams, 1853, non *Leiostracus* Albers, 1850)." *Subularia metcalfei* (A. Adams) therefore became the type of *Subularia* Monterosato.

The whole may be condensed into the following formula:

*Subularia* Monts., 1884, type *Subularia metcalfei* (A. Ads.) = *Leiostraca* H. & A. Adams 1853, type *Leiostraca metcalfei* A. Ads.; not *Leiostracus* Albers 1850.

Since *Subularia* and *Strombiformis* have been sadly confused in the past, I add a copy of a figure of the type of *Subularia* (pl. 5, fig. 2), and of a typical *Strombiformis* (pl. 5, fig. 1, *Strombiformis lapazana* Bartsch).

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#### A NEW PLEISTOCENE MOLLUSK LOCALITY IN NEW MEXICO.

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BY JUNIUS HENDERSON.

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In the spring of 1916 Dr. Max M. Ellis, with Messrs. G. C. Roe and B. Jaffa as assistants, while collecting fishes in New Mexico, found a deposit containing many small land and fresh-water shells. It is in the bank of the North Spring River, about two and a half miles below (east of) Roswell. The valley was evidently at one time deeper than now, but had been partly filled by mud, sand and fine gravel. More recently the stream has cut into the deposit to a depth of fifteen feet. The thick fossiliferous stratum is at the base of the bluff, extending into the water and possibly far below, and is covered by about ten feet of soil, chiefly adobe. Twenty pounds of the weathered material yielded (in addition to abundant fragments of *Chara* and other plants, a few fragments of mammal bones and 400 caddis cases of the genus *Helicopsyche*) the following mullusks :

- 3500 *Pisidium* spp. (loose valves).  
 373 *Vallonia gracilicosta* Reinh.  
     2 *Carychium exiguum* Say.  
 23 *Pupoides marginatus* (Say).  
 20 *Bifidaria armifera* Say.  
     5 *Bifidaria contracta* Say.  
     5 *Bifidaria pellucida hordeacella* Pils.  
 136 *Bifidaria procera cristata* Pils. & Van.  
     2 *Pupilla muscorum* (L.).  
     5 *Vertigo* sp.  
     5 *Cochlicopa lubrica* (Müll.).  
     2 *Polita indentata* (Say).  
 400 *Zonitoides minusculus* (Binn.).  
 13 *Helicodiscus eigenmanni arizonensis* Pils. & Fer.  
     2 *Succinea* sp.  
 15 *Planorbis antrosus* Conrad.  
 100 *Planorbis parvus* Say.  
 100 *Physa virgata* Gld.  
     6 *Ancylus rivularis* Say.  
 4500 *Paludestrina seemani* (Ffld.).

There were also 75 seeds of "Snow-on-the-Mountain," *Dicrophyllum marginatum* (Pursh), but they may have been blown into the weathered material recently and hence may not be fossil. They are entirely unaltered.

The same collectors obtained 30 *Planorbis antrosus* Conrad and 5 *Physa* sp. about two miles below the head of the North Spring River west of Roswell, but did not bring in any of the weathered material or stop to examine the deposit thoroughly.

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#### NOTES ON *ACELLA HALDEMANI* (DESH.) BINNEY.

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BY FRANK C. BAKER.

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Notes on the ecology of this the slenderest of our Lymnaeas are rare, and its whereabouts during a large part of the year has been a matter of conjecture. Dr. Reynold J. Kirkland of Grand Rapids, Michigan, has collected the species extensively and his observations are of interest in connection with the

writer's notes which follow. Kirkland says,<sup>1</sup> "This is a deep water species, which migrates shoreward in the fall, doubtless for spawning purposes, as adults only have been captured, but this should be verified by dissection. September 25 is the earliest date they have been taken, and they remain until ice forms, how much longer is not known." Sargent<sup>2</sup> reports them in Heath Lake, Minnesota, in the fall, and adds, "Where do they keep themselves in the summer?"

This question can now in a measure be answered as the species has been found in July in Lower South Bay, Oneida Lake, in several localities. The specimens collected were all young, none exceeding 11 mm. in length, the greater number being 3 to 5 mm. long. They were invariably found on the leaves or stem of the pond-weed (*Potamogeton interruptus*). It is evident that they do not retire to very deep water but only to the zone where this pondweed, or perhaps other suitable vegetation grows. This may be in water from two to six feet deep. The shells are very difficult to find, as in life they are nearly the color of the plant and look exactly like a young leaf beginning growth. This plant is admirably adapted for the use of this snail, its leaves being very long and exceedingly narrow and flat. Five specimens gave the following measurements:

Whorls 2; length 3.0; breadth .6; aperture length 1.5; breadth .5 mm.

Whorls  $2\frac{1}{4}$ ; length 4.0; breadth 1.0; aperture length 2.0; breadth .75 mm.

Whorls  $2\frac{1}{2}$ ; length 5.5; breadth 1.4; aperture length 2.0; breadth 1.0 mm.

Whorls 3; length 8.0; breadth 1.7; aperture length 3.5; breadth 1.0 mm.

Whorls  $3\frac{1}{4}$ ; length 10.5; breadth 2.5; aperture length 5.0; breadth 1.5 mm.

The whorls are usually flat-sided as in the adult shell, but in two specimens they were somewhat rounded. Adult specimens from Nicholson's Bay, Oneida Lake, measure :

<sup>1</sup> Baker, *Lymnaeidae of North and Middle America*, page 197, 1911.

<sup>2</sup> NAUTILUS, IX, page 127, 1896.



Length 25.0 ; breadth 4.0 ; aperture length 10.0 ; breadth 2.25 mm.

Length 25.0 ; breadth 4.0 ; aperture length 10.0 ; breadth 2.0 mm.

Length 23.0 ; breadth 4.0 ; aperture length 10.0 ; breadth 2.5 mm.

Adults are said by Kirkland to appear in Reed's Lake, Michigan, about September 25 and to be common until Thanksgiving Day or later. They were observed in the west end of Oneida Lake, in several places, on September 10 and continued to be noted until the middle of October, when they were quite abundant. At this time work was discontinued by the writer.<sup>1</sup> No adults were seen in July, 1916, at which time several of the habitats were visited in which *Acella* was abundant in the fall of the previous year. It is evident, from the observations of Kirkland, Sargent, and the writer that *Acella* migrates to deeper water sometime in the late fall or early winter, probably when ice forms to such an extent that the surface vegetation upon which it rests and feeds is destroyed. That it will resist cold weather is shown by the observations of Kirkland who found it on Thanksgiving Day when the ice had formed, and by the writer who collected it in October when the water was so cold that it numbed the fingers, in fact ice had formed the morning of the same day.

*Acella* is purely an inhabitant of vegetation, at least as far as the recorded observations indicate, and as far as known has never been found on any other material. Kirkland and Sargent note it on the under side of lily leaves. In Oneida Lake it has been noted on the following vegetation :

Smith's bullrush (*Scirpus smithii*) on the stem.

Floating pond-weed (*Potamogeton natans*) on leaves and stem.

Pond-weed (*P. interruptus*) on leaves and stem.

White water-lily (*Castalia odorata*) on leaves and stem.

Yellow water-lily (*Nymphaea advena*) on leaves and stem.

The habitat in Oneida Lake is invariably a sheltered cove, bay, or other spot protected from violent wave action.

<sup>1</sup>Baker, Technical Bulletin, N. Y. State College of Forestry, IV, pages 283-284, 1916. There are also other references to the ecology of the species in other parts of the volume.

Information concerning the breeding habits of *Acella* are still a desideratum. It occupies the surface in shallow water (one to three feet) in the fall; but where does it lay its eggs? None were observed in the fall of 1915 though adults sexually mature were collected. It may be that the animal descends to the pond-weed zones in the winter and lays its eggs on the *Potamogeton* and that they subsequently hatch out in the spring. Certainly, as young were found in July which had  $3\frac{1}{4}$  whorls and were 10 mm. long, they must have been hatched at the latest in the spring. We are ignorant, also, of whether the maximum growth is completed in one or more years. There is much about this most characteristic Lymnaeid that is still to be learned.

*New York State College of Forestry,  
Syracuse University.*

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NEW LAND SHELLS FROM ALABAMA AND ARKANSAS, WITH NOTE ON  
POLYGYRA ALBOLABRIS AND P. ZALETA.

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BY GEO. H. CLAPP.

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VITREA (PARAVITREA) CONECUHENSIS n. sp. Pl. 5, figs. 5, 6, 7.

Shell thin, depressed, umbilicate, the umbilicus being about 1 mm. in diameter and showing all the whorls; color light horn, highly polished; whorls 6, the first five closely coiled, the last rapidly expanding. Surface sculptured with spaced, unequal, radial grooves stopping at the periphery, which is slightly sub-basal. Aperture subtriangular, lower lip slightly flattened and reflected where it joins the columella. Adult shells are toothless, but a young shell of  $4\frac{1}{2}$  whorls,  $2\frac{3}{4}$  mm. in diameter, shows a single pair of small tubercular teeth.

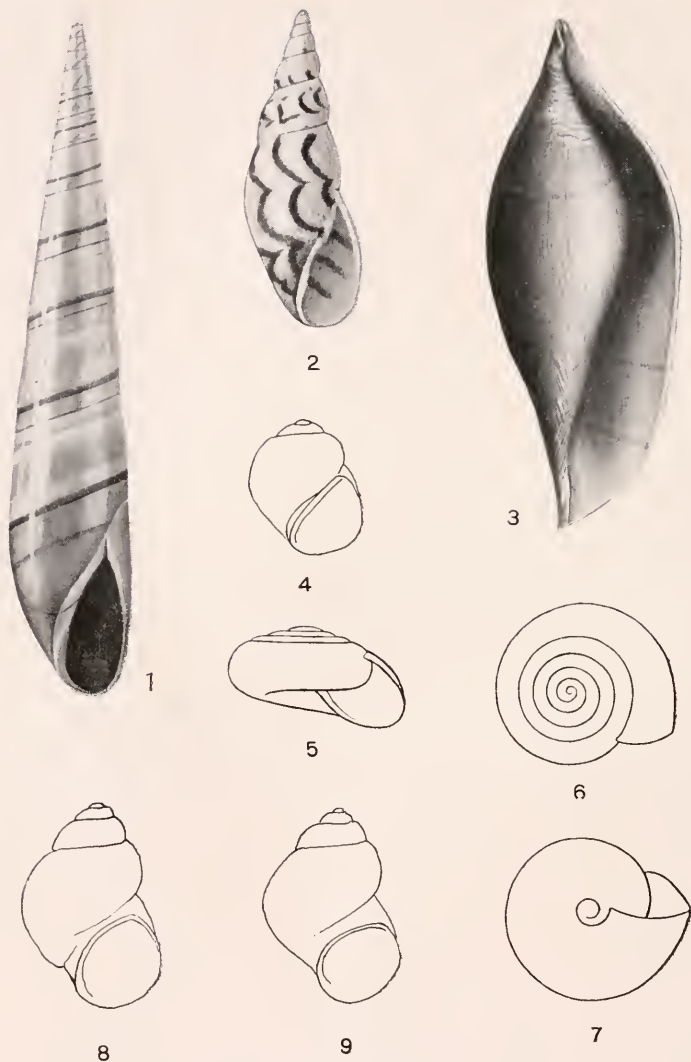
Diameter  $4\frac{1}{2}$ , altitude  $2\frac{1}{2}$  millimeters.

Evergreen, Conecuh Co., Alabama. Collected by Herbert H. Smith.

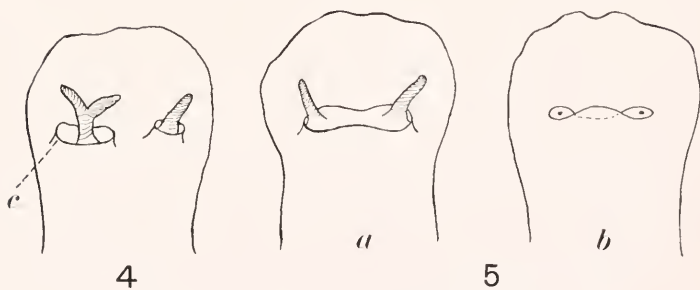
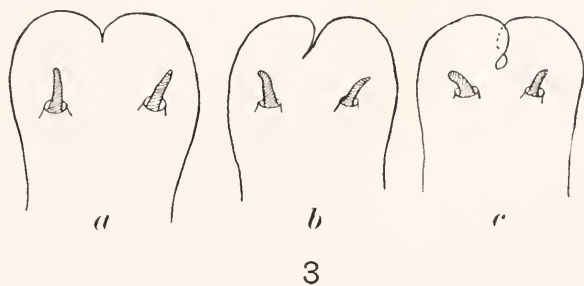
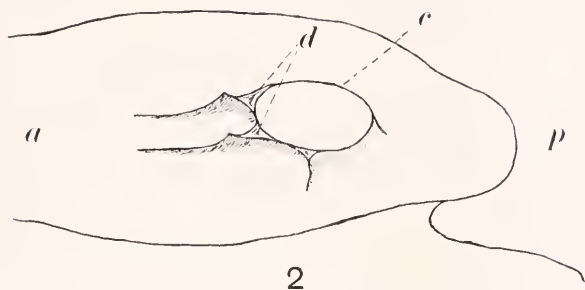
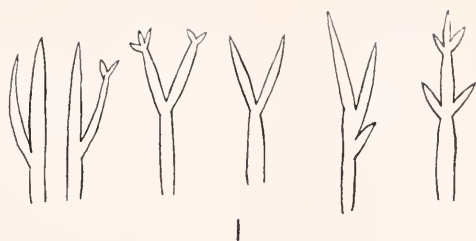
Types No. 8111 of my collection. Paratypes in collection of Bryant Walker, Detroit, Mich.

This species resembles *Vitrea simpsoni* Pils., but has about one more whorl in the same diameter; it is also less depressed, and the basal lip is less flattened.





1. STROMBIFORMIS LAPAZANA BARTSCH.
2. SUBULARIA METCALFEI A. AD.
3. NEOSIMNIA CATALINENSIS BERRY (p. 21).
4. AMNICOLA NEOMEXICANA PILSBRY.
- 5-7. VITREA CONECUHENSIS CLAPP.
- 8, 9. AMNICOLA DESERTA PILSBRY.







## POLYGYRA LABROSA FIMBRIATA n. var.

Differs from the type in having a well-developed peripheral fringe of two or three rows of hairs about 0.25 mm. in length, the hairs also showing as a sutural fringe, and the "prostrate hairs," of Bland's original description, are much more elevated. On the base are spiral rows of short, erect bristles continuing to the umbilicus. Aperture typical.

Diameter 11, altitude 6 mm., whorls 5.

Sulphur City, Washington Co., Arkansas. Collected by A. J. Brown, Jan., 1917. Types No. 8112 of my collection. Paratypes in collection of A. J. Brown. Fifteen adults and as many young examined.

Over forty *labrosa* from seven localities in Arkansas and twenty from Galloway, Mo., including one from Bland and two others labeled "Identified by Bland," were examined. Three shells from Clinton, Ark., show traces of hairs and three fresh shells in the Galloway lot also show some hairs, but in neither case are they as prominent as in the Sulphur City shells.

In P. A. N. S., Feb. 1903, p. 202, Dr. Pilsbry says: "In all other *Stenotremes* except *P. barbiger* (Redf.) the cuticular hairs form a comparatively close pile. . . . In no other (except *pilsbryi*) do they form a series of circular, concentric fringes. *P. barbiger* has a single fringe of similar filaments, usually persisting at the suture only." This is true of the average cabinet specimen, but both *barbiger* and *spinosa* have a peripheral as well as a sutural fringe, and both have hairs arranged in spiral rows on the base when carefully prepared, as shown by hundreds of specimens collected by Herbert H. Smith in Alabama, and I have shown in the NAUTILUS, Vol. XXVII, p. 12, that *P. edwardsi* has well developed fringes when fresh. In the note on *edwardsi* there is a mistake in giving the length of the hairs as 1 mm., it should be  $\frac{1}{2}$  mm. When the note on *P. edwardsi* was written I had forgotten that A. G. Wetherby had called attention to this same fact in his very valuable paper "Some Notes on American Land Shells," No. 1, p. 2 of an undated "separate." The paper was published in the Journal of the Cincinnati Society of Natural History.

NOTE ON *Polygyra albolabris* AND *P. zaleta*.

In some regions where *P. albolabris* and *zaleta* are found together occasional elevated specimens of the former or depressed ones of the latter occur and it is very difficult, at first glance, to say to which species they belong. If, however, the shells are examined under the microscope with a magnification of about 25 diameters they can be readily separated, as *zaleta* looks polished in the high light while *albolabris* is dull. This is due to the fact that between and on the ribs of *albolabris* are fine, vertical wrinkles in the epidermis which are absent in *zaleta*. As a rule *zaleta* is also much lighter in color than *albolabris*, or if dark specimens are found they are generally much lighter on the base, and just behind the aperture there is invariably a patch of much lighter color than the body of the shell.

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SOME STRUCTURAL VARIATIONS IN *CHROMODORIS ZEBRA*.

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W. J. CROZIER.

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Contributions from the Bermuda Biological Station for Research, No. 64.

Abnormalities of a minor character are by no means uncommon in nudibranchs, and, while these features are usually not of any great morphological significance, some of them seem sufficiently curious to warrant description. I have noted several such deviations from the typical structure while examining a large number of specimens of *Chromodoris zebra* Heilprin.

Smallwood (1910) has described some of the variations in the coloration of this animal, and has also referred to the variability shown by the branchiæ, particularly in the manner in which one or several of these organs terminate by division of their free ends into several parts. I have elsewhere (Crozier, 1917) made note of the variation in the number of the glandular papillae which occur upon the ventral surface of the posterior border of the mantle.

Variation in the branchiæ is, in fact, somewhat more frequent and more extensive than Smallwood observed. Not unusually, branchiæ are to be seen which not only divide to a greater or less extent at their tips, but also show a branching at some

distance from the tip (Fig. 1). In many instances the presence of an accessory branchia arising in this way is unaccompanied by duplication of the pointed tips.

The high sheath which surrounds the branchial rosette is normally quite smooth. In only one of the many hundreds of *Chromodoris* which I have handled was there noted any other condition. In this single specimen, however, there were three distinct ridges running from the dorsal surface to the external margin of the branchial collar; two of these ridges were extended in an anterior direction, their edges being sharp and prominent, while the third, less conspicuously developed than the other two, was on the left side of the collar. The appearance of these structures is shown in Figure 2, where may be seen the manner in which the ridges were united with the collar.

The edge of the mantle occasionally shows evidence of injury, and this may explain the origin of modifications found at the anterior end of the mantle in several specimens. These modifications consisted in a well-defined median indentation of the buccal veil, which was thus symmetrically bilobed. But this region of the mantle is almost always folded at the margin to some extent, and since the pigment pattern frequently shows no local disturbance at the region of the indentation, the feature which is shown in Figure 3 (particularly at *c*) may be merely an unusually strong expression of a tendency to wavy folding.

The "rhinophores" of *Chromodoris* (cf. Arey, 1917), which are usually straight, may appear somewhat bent near the tip, or may even assume a slightly corkscrew shape. In one individual there was found a bifurcating "rhinophore" on the left side; the one on the right side was normal. As shown in the accompanying sketch (Fig. 4), the rhinophoral collar (*c*) had grown in such a manner as to accommodate the additional structure.

One specimen occurring among a lot of 231 collected early in January, 1917, was found to possess a striking modification of the rhinophoral collars. Figure 5 depicts the condition referred to, which consists in the fusion of the two pockets, into which the "rhinophores" are respectively retracted, so that but a single depression provided with a single collar is present

in this particular animal. The posterior edge of the collar was higher than the anterior one, and when both "rhinophores" were retracted this posterior border of the collar was folded over the anterior edge in such a way as to lead to the appearance of two minute openings into the single pocket.

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- CROZIER, W. J. 1917. The nature of the conical bodies on the mantle of certain nudibranchs. NAUTILUS, Vol. 30, p. 103-106.
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#### DESCRIPTION OF FIGURES, Plate VI.

- FIG. 1. Branching gills.
- FIG. 2. Ridges about the branchial collar; *a*, anterior; *b*, posterior; *c*, branchial collar (gills not shown); *d*, triangular depressions.
- FIG. 3. Lobed condition of the buccal veil.
- FIG. 4. A bifurcate rhinophore; *c*, collar of rhinophore.
- FIG. 5. Fused rhinophoral pockets; *a*, rhinophores extended; *b*, retracted.

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#### A METHOD OF PRESERVING LARGE NUDIBRANCHS.

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W. J. CROZIER.

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Contributions from the Bermuda Biological Station for Research, No. 65.

Those who have had occasion to study collections of nudibranchs, especially when they include specimens of the larger tropical species, have doubtless often wished that the organisms submitted for their examination had been so preserved as to exhibit in more natural fashion the appearance of these creatures when alive. After various attempts to secure good preparations, I find that the simple procedure herein outlined gives tolerably fair results. The method has been tried almost exclusively upon *Chromodoris zebra*, but it seems likely that other large forms will yield equally good preservations when treated in the same way.

A saturated solution of cocaine hydrochloride is made up in sea water, and 2-3 cc. of this solution is then injected into the

heart (or into the region of the heart) of *Chromodoris* by means of a syringe and hollow needle. A "Record" syringe, such as is used by surgeons, is useful for this purpose. Within an hour or so—depending on the temperature, on the size of the animal, and on the exact amount of the narcotic that has been injected—the nudibranch will be fully anaesthetized, usually with the gills and rhinophores fully extended; frequently also the genital papilla will be protruded, and the pharynx everted. It is advantageous to add a few crystals of chloretone to a small volume of sea water containing the nudibranch; furthermore, several injections of the cocaine may sometimes yield a better result than a single dose.

When completely anaesthetized, the animal may be killed and fixed in 75 per cent. alcohol. Precipitated slime, on the surface of the body, can be subsequently removed with a camel's hair brush. In order to avoid the distortion which inevitably results if these large nudibranchs are fixed while they rest upon the bottom of a dish, it is well to suspend them vertically in the fixing fluid until they are killed and begin to harden. This may be done by gripping the caudal extremity of the foot between the jaws of a light "artery clamp" or some similar instrument; or a thread may be sewn through the foot for this purpose.

The injection of a relatively small amount of a narcotic usually gives much better results than does the attempt to anaesthetize these nudibranchs by adding magnesium sulphate, or chloretone, to the seawater containing them. In the latter method, not only does the surface frequently become covered with a number of vesicular blebs, edematous in appearance, but also the proper time for removal to the killing fluid must be selected with considerable care. A similar procedure, involving the injection of chloretone into the body-cavity, has been employed by Pearse<sup>1</sup> with holothurians.

The proper penetration of the fixative is of course important for the conservation of the internal organs. This result may be assured if a fair volume of the fixative is employed, and if in addition an incision several centimeters long is made along the edge of the mantle (preferably on the left side) previous to immersion in the fixative.

Frequently it is desirable that the normal integumentary

<sup>1</sup> Pearse, A. S., 1910. Eine Methode, um Holothurien in ausgedehntem Zustande zu konservieren. Zeits. f. biol. Tech. u. Method., Bd. 2, p. 94-95.



colors of the nudibranch should be preserved as faithfully as possible. Two fluids which I have found useful with *Chromodoris zebra* are Merkel's fluid and the sublimate-acetic mixture (saturated aqueous solution of sublimate plus 5 per cent glacial acetic acid). The sublimate mixture in particular gives a very fair preservation of the blue pigment of *Chromodoris*, which is permanent for six months at least, if not for a longer period. The sublimate precipitates the blue substance so that it is no longer soluble in aqueous alcohol, and at the same time renders it insensitive to the acetic acid, which otherwise would cause the substance to become pink. Possibly the platinic chloride in Merkel's fluid has a similar action, since I find that both mercurous salts and platinic chloride precipitate the blue pigment from aqueous solutions.

*Agar's Island, Bermuda.*

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